The Electrical World.

VOL. XXXII. NEW YORK, JULY 23, 1898. No. 4.

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY,

9 Murray Street, New York.

Telephone Call: Cortlandt 924. Cable Address: "Electrical," New York.

New England Office, 620 Atlantic Ave., Boston.
Western Office, 936 Monadnock Block, Chicago.
Philadelphia Office, 929 Chestnut Street.

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POWER FROM BLAST FURNACES.

Great interest has been awakened in Europe by the results of recent experiments in the utilization of blast furnace gases in gas engines. For a long time a part or all of the waste gases, which are rich in carbonic oxide and other combustible ingredients, has been used as fuel under boilers at many furnaces, but generally in a wasteful way and without any attempt to recover the enormous energy that it contains. The results obtained in the recent experiments are of great significance. It has been demonstrated that these gases afford a source of power readily utilized, and that they can be consumed to great advantage in gas engines.

The main difficulty in the use of these gases in internal combustion engines seems to have been due to the dust with which they are laden. Means for washing the gases and freeing them of this undesirable constituent have been perfected. After going through several coke "scrubbers" and being washed by a spray of water the gases contain less than one grain of impalpable dust to the cubic foot, and this is said not to produce any ill effect in the cylinders. As many as 2000 horse-power hours can be actually developed from the gases resulting from the smelting of one ton of pig iron. What this means in this country is hardly yet understood, but a few figures will show what an important source of power is wasted, and what a fortune goes up annually in smoke.

In May, 1898, there were 194 furnaces in blast in the United States. The weekly productive capacity of these furnaces was at that time 243,163 tons. Assuming that by electrical means 50 per cent. of the mechanical energy obtainable from their waste gases could be delivered to points of utilization, a continual delivery of very nearly 1,500,000 horse-power could be obtained. If this enormous amount of power could be marketed at $5 per horse-power year, over and above the cost of operation and fixed charges of the systems necessary, there is obviously an annual waste of $7,500,000.

Blast furnaces, unlike waterfalls, are situated as a general thing in or near centres of industry where the market for power is ready made. The figures given above make one of the best arguments for energetic and careful work upon the perfection of large gas engines yet presented.

A COMPARISON OF THE TWO SYSTEMS OF MULTIPLE RATE METERING.

The perplexing question of how to divide the charges of a central station between the different consumers somewhere nearly in proportion to the cost of the consumers' loads, and of encouraging the use of electrical energy with conditions under which it can be cheaply generated and discouraging its use at times or under circumstances when it is expensive, has brought out two more or less satisfactory attempts at solution, both involving the use of separate rates which the consumer must pay according to the conditions of his demand. Theoretically, of course, an infinite number of rates should be charged, the rate being raised step by step with every step of increased cost, but it has been found in practice that more than two rates complicate matters unwarrantably with either system.

The whole problem is due to the fact that the customer's demand

is more or less intermittent, invariably greater at certain hours of the day than at others. Sufficient machinery must, therefore, be provided to carry the load at this time when it is greatest, and more or less of this machinery is non-productive of revenue, but a continual source of expense at other times. Of the two multiple rate systems, that which is known as the Wright demand system has come into the wider use in this country. In this system, by means of some measuring device, the maximum load of the customer's installation for any given period is recorded, the total number of watt hours for the same period being recorded by another instrument. A lower rate is given on all of the load over and above a certain amount proportional to the indication of the instrument recording the maximum load. The result of this method of fixing the charges is to give to those consumers with steadiest loads the lowest rates and, vice versa, to those with the most unsteady loads rising to high values at times and falling far below these at other times the highest rates. A further result is, of course, if the consumer comprehends the action of the system, to render him more anxious to steady his load, or rather to reduce his maximum. How great this effect is it is hard to state, but it is probable that at the time of the maximum the consumer does not realize it, is engrossed with other things, and the effect is slight. The principle on which this system is founded is that the central station must be provided with an equipment of boilers, engines, generators, etc., sufficient to carry his maximum load, and that in proportion as this maximum load is much greater than the average, this machinery is idle the greater part of the time, hence the consumer with the greatest ratio of maximum to average load should pay more for the power he uses. Obviously, this is not quite true, unless the maxima of all consumers occur at the same time; for example, if the maximum of one new consumer's load curve occurred during the forenoon, while another occurred at the time of the peak of the station load curve, the latter would require the addition of sufficient machinery to carry that consumer's maximum load, while the former would require only sufficient to carry the load added at the time of the peak of the station load curve. The two consumers would by the Wright demand system be charged the same rate. In so far, however, as the individual maxima occur together the system may be made to properly divide the charges.

The other system of multiple rate metering is based on the time of day at which the current is taken, a higher rate being charged for that used during certain hours when the station is heavily loaded, and when, therefore, any addition to the load necessitates a corresponding increase of the equipment, which increased equipment is idle and non-productive at other times. To be consistent a large number of rates should be charged, the rates increasing from minute to minute as the station load curve runs up, since the increments of apparatus required at or near the very peak of the load are idle a far greater proportion of the time than those required further down the load curve. The Wright demand system obviously accomplishes this sliding scale of charges by the simple means of varying the proportion of the load paid for at a higher rate, according to the height of the peak. The two-rate system has, however, the enormous advantage that it is readily comprehended by the consumer. If the latter is told that he has to pay twice as much for burning a lamp between 5 and 8 P. M. as at any other time of the day, he is much more likely to understand it than if told that his rate depends on the ratio of the integrated watt hours to the maximum instantaneous demand. He is also much more likely to take care to keep his average rate down by watching his lights during the high-rate hours, economizing more then than at other times of the day, thus tending to improve the central station load curve.

On the other hand, this two-rate system does not properly differentiate between consumers, one of whom, to take a concrete case, is very irregular in the use of light, while the other keeps his lights burning comparatively steadily, other conditions remaining the same. To illustrate this point, let us suppose one load is a theatre load, requiring an enormous supply of current for a few hours each day and nothing the rest of the twenty-four hours; while another load, consuming exactly the same number of watt hours per month, is perfectly steady in its demand. If the same percentage of each is consumed during the hours when the higher rate is charged, the amount charged the two consumers will be the same, while the cost to the central station of the intermittent load may be three or four times that of the other.

What is needed is a combination of the elements of the two systems, but no means of accomplishing this with simple mechanism and possessing the essential requirement of easy comprehension on the part of the consumer has so far been devised. A maximum demand meter so arranged as to record only at the time of the maximum load at the switchboard would come much nearer a proper solution than does the demand meter as now used, since it would show the exact proportion of the station equipment necessary to carry the load to which it is attached and would therefore give the data for a proper division of the fixed charges; a thing the Wright demand meter by itself does not do unless the maximum it records occurs simultaneously with the station maximum.

BRUSH HOLDERS.

In the pioneer days of dynamo construction no attention was paid to the design of the brush holders, their details being left largely to the mechanics' fancy when the time arrived for their construction. By far the most frequent troubles with direct-current machines occur at the commutator and poor brush holders are often the cause. In general it may be said of any machinery that the most trouble may be expected with the small, apparently insignificant parts, and practically the only small mechanism attached to dynamos is the brush holder. Care with this detail is, therefore, imperative. Interesting descriptions of various designs of brush holders will be found in another column.

DISRUPTIVE DISCHARGES AND SPARK GAPS.

It is usually considered that the connection of an ohmic resistance in series with a discharge gap does not affect the breaking down strength or voltage of the latter. Experiments described by Mr. A. J. Wurts in another column quite disprove this theory. The connection of 120 ohms in series with a double spark gap aggregating 1-16-inch air space so increased the resistance to the passage of the discharges that they preferred to jump a much wider gap placed in shunt around the test gap and its resistance. It would certainly seem as though the charges gathering on the terminals as the potential difference rises would not be affected by ohmic resistance, and that the breaking down point of the shorter air space would be the sooner reached. It is difficult to see why the variation of other gaps in the circuit affects this as it does, since the electrostatic stress should distribute itself over all the gaps in the line. This is a point where experiment does not justify theory and the theory will have to be changed. It would be interesting to know how various lightning arresters would act under experimental conditions more nearly imitating service conditions; for example, connected in secondary circuits inductively affected by disruptive discharges in their primaries.

Some Modern Brush Holders.

The electrical show in New York City brought together a number of electrical machines with such interesting designs of brush holders that a brief description of the varieties there shown may be of interest. The most conspicuous feature of the tendency in the present use of brushes on direct-current machinery is the widespread adoption of what is known as the reaction brush. As this type is of such recent design that its properties may not be generally understood, a description of its peculiarities may be relevant at this time.

A characteristic example of this holder may be seen in Fig. 1, which shows the form of it generally adopted for all apparatus manufactured by the Walker Company, with the exception of street railway motors. As may be seen in this figure, the holder is extremely simple, consisting of one main casting with but one surface necessarily finished, namely, that against which bear the sides of the carbon brushes. A finger or follower forces or wedges the beveled back end of each carbon brush between the commutator and the bearing surface of the holder, the finger in turn being pressed against the brush by the action of a torsional spring, the end of which can be hooked by hand in any one of a number of notches in a segment of the follower casting, thus adjusting the pressure according to the notch in which the spring is caught. A tooth on the follower prevents the end of the latter from falling on the commutator when the brush is removed.

The advantages claimed for this type of brush holder are, in the first place, the freedom of the brush to follow all ordinary irregularities in the surface of the commutator, and to follow them, not by oscillating about an axis and thereby destroying the parallelism of the face of the brush, but by moving in a straight line toward or from the commutator. It is obvious that this gives a much more continuous contact of the whole face of the brush against the commutator bars

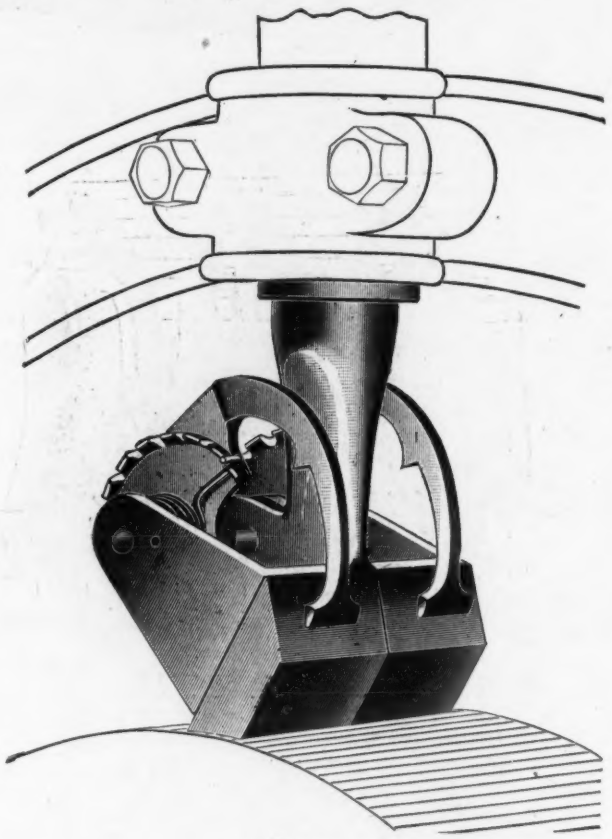


FIG. 1.

than if the former rocks around a stud whereby it is tilted up until only its inner edge makes contact on high parts, and tilted down until its outer edge makes contact on low parts of the commutator if the latter is at all out of true. To follow narrow irregularities promptly the brush and other moving parts must be of small inertia, and it is obvious that this requirement is fulfilled in this type, the brush itself being quite small and the follower a very light brass finger. Another peculiarity is the closeness with which the metal parts of the holder may be brought to the face of the commutator, the metal parts being stationary and no margin, therefore, being necessary for wear. This shortens the distance which the current must travel through carbon and also increases the rigidity of the brush at the commutator surface, preventing chattering. Another advantage is the facility of removal, the brush being easily lifted out with two fingers at any time, even when the machine is running, no clamping devices or screws being disturbed and no adjustment being lost, the brush settling exactly into the same place when restored.

Another advantage of this holder is the fact that no box or frame

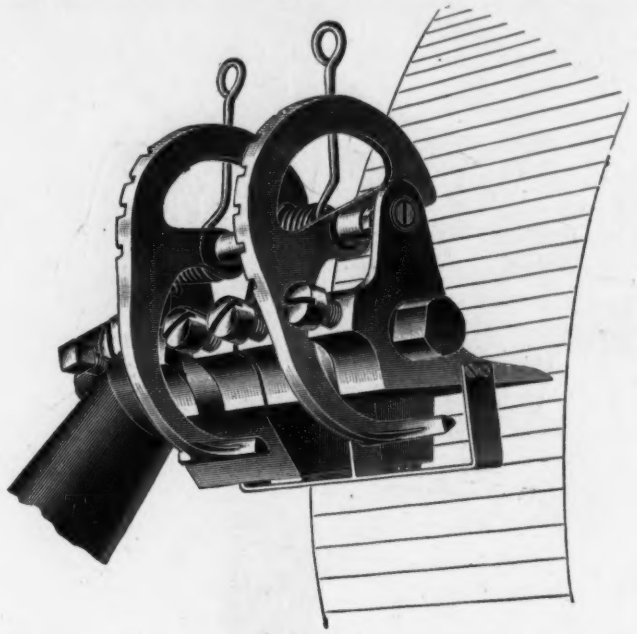


FIG. 2.

is used around each brush, hence the brushes may be in actual contact with one another side to side, and the whole face of the commutator with a slight margin at each end may be made use of. This increases the available area of contact with a given thickness of brush and face of commutator about 10 per cent. over other forms.

As there is no tightly bound or clamped contact to carry the current from the brush to the holder, the surface lying against the holder being alone depended on for this purpose, it is essential that the brush be well plated, and that this one side of it at least be flat and true. For this reason sawed or ground carbons are preferred to moulded carbons for this holder. In case moulded carbons are used care should be exercised that this side of the carbon is not rounded. For very high-current capacities the brushes are fitted with copper sheets covering the side which bears against the holder and bending over the top angle of the brush, also covering the beveled side against which bears the follower. These sheets are soldered to the brush, and, if ground, the surface of the holder being milled, a very satisfactory contact is obtained. A remarkably light pressure against the commutator surface is used, this being possible owing to the ease with which the brush adjusts itself to irregularities. On this account the wear of both commutator and brush is greatly reduced, good, fine grain carbons running for years without renewal. The area of contact of the brushes on the commutator is figured at about the same value as that with other types, namely, 30 amperes per square inch, the contact between the brush and the holder being as a rule about twice this area, or 15 amperes per square inch.

The brushes are said to work equally well whatever the direction of rotation may be, but it is customary to run the commutator toward the brush from the holder side, that is to say, right-handedly, as shown in Fig. 1. This would appear to give a tendency to trip the brush, but no ordinary irregularity or high bar is found to do so in practice. Nothing short of a segment rising perhaps one-sixteenth of an inch above the adjacent surface acts to throw the brush out of position. The angles used by different makers vary, but the standard set by the original designer of this type of brush holder is 60 degrees between the bearing surface of the holder and the face of the commutator and 45 degrees between the surface of the holder and the top bevel of the brush against which bears the follower.

A modification of this holder in which these angles are not exactly followed, but in which the face of the holder is almost radial, is shown in Fig. 2, this being the arrangement used by the C & C

Electric Company. Another peculiarity used on the machines of this make is the strap or band around the brush preventing its falling out, this being necessary with the peculiar angle used, since the follower does not tend in this case to wedge the brush, so to speak, between the commutator and the face of the holder. It is to be noticed that here also the holders, one for each brush, are mounted on a stud in the ordinary manner instead of being all cast together with a supporting post as in the Walker design. The stud of the C & C machine is flattened, as shown, to give all of the holders the same rake when the brush holders are fastened with their set screws on the flat of the stud.

Still another modification of this is that shown in Fig. 3, and used

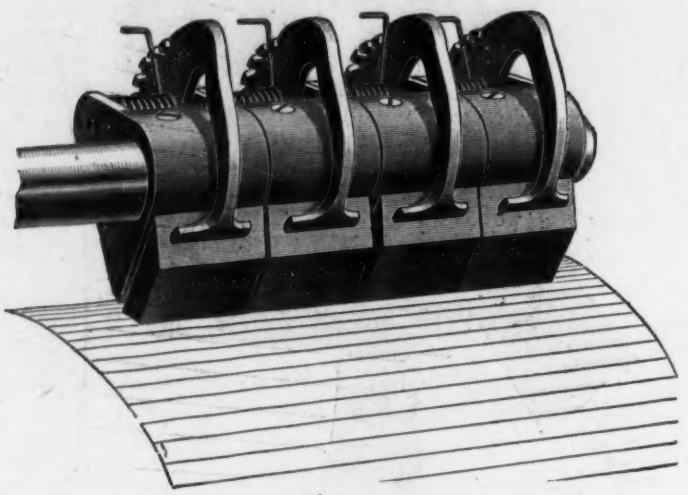


Fig. 3.

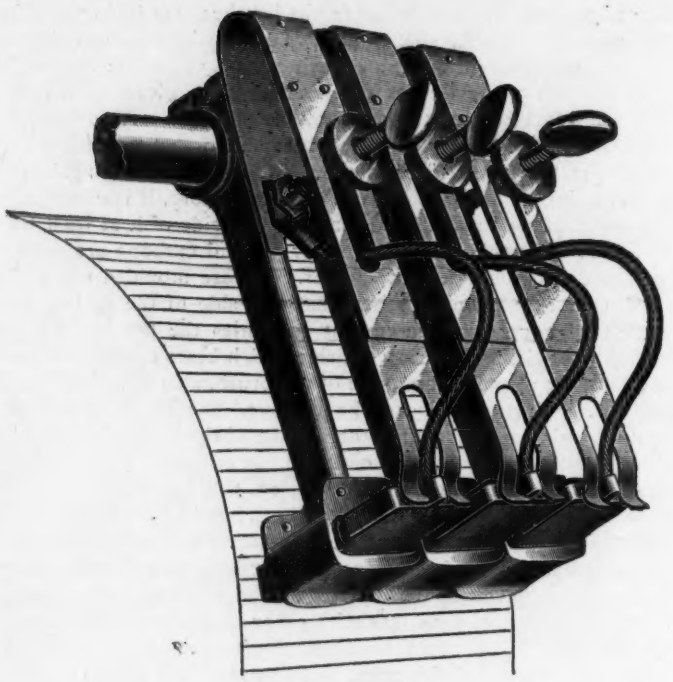


Fig. 6.

by the Eddy Electric Manufacturing Company. Here it will be noticed that there is no flat on the stud, but a V-shaped groove is milled into it, into which pointed set screws are driven. It will also be noticed that here the follower is bent somewhat, so that its segmentally shaped rear end is at one side of the holder, practically the whole width of which is therefore available for the coiled spring. In this, as in several other types described below, the holders need not butt against each other on the stud, but may be spread apart, and brushes wider than the holders may be used. A holder, for instance, 1 inch wide, is used in practice with brushes up to 1¼ inches in width, and larger holders in proportion. By utilizing this possibility and by adding to the number of holders on the stud as desired, a small number of standard sizes serves for a very large range of capacities. In fact, but two sizes of brush holder are necessary for a line of machines, ranging in capacity from 1 to 2000 kilowatts.

Fig. 4 shows the arrangement used by the Bullock Electric Manufacturing Company, the holders proper being of the most simple construction mounted on studs swung in trunnions, by which the angular position of the different groups of brushes may be relatively adjusted. There is provided for use with this holder a brass gauge shown in the upper part of the figure by which the proper angle between the face of the holder and the tangent of the commutator may be obtained.

A modification of this holder differing greatly from those already described, is shown in Fig. 5. Here the torsional spring with its simple adjusting hook is replaced by a helical spring shielded

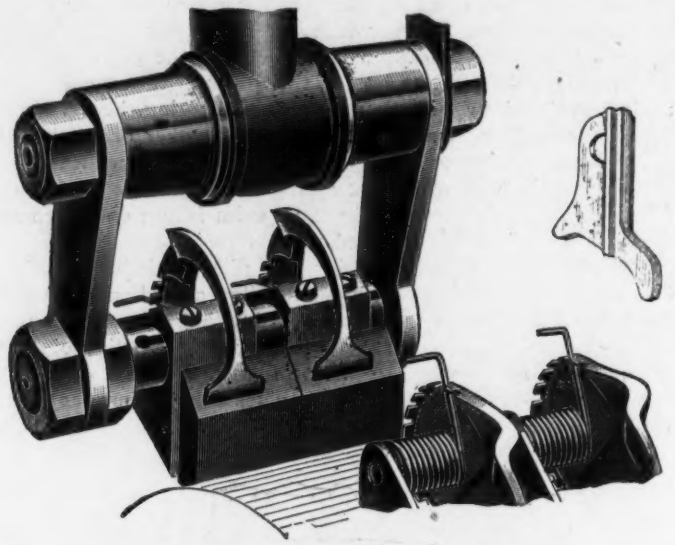


Fig. 4

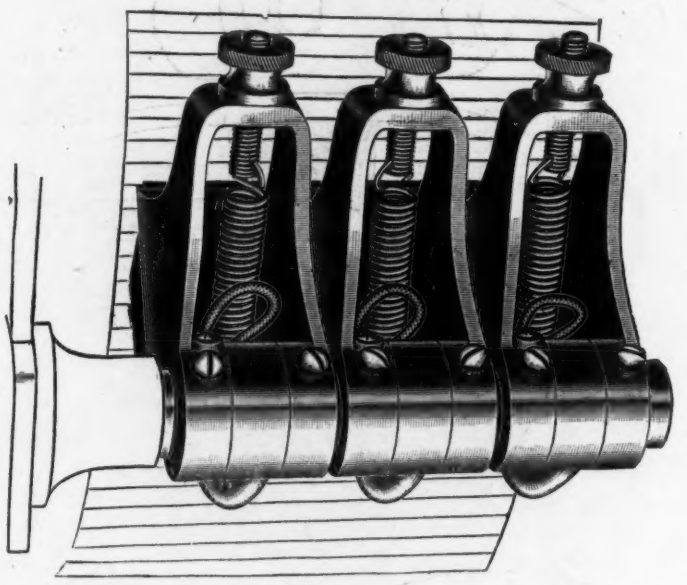


Fig. 5.

by the walls of the holder and adjusted by a screw and nut, the tension of the spring being depended on to prevent the screw working under vibration. The follower here is pivoted on the main brush holder stud, and the surface of the brush bearing against the holder is not depended upon for conductivity, a flexible braid being used, attached at one end to a copper strip riveted to the brush and at the other end fastened under a screw in the holder. The advantage of increased conductivity is offset against the disadvantage of greater difficulty in removal and replacement. This modification is that used by the Onondaga Dynamo Company.

The reaction brush is the invention of Mr. R. N. Baylis, and was patented by him September 12, 1893, No. 504,901. Beside the companies mentioned above which use it as licensees under this patent

are the following: The E. G. Bernard Company, the Keystone Electric Company and the Triumph Electric Company. The Baylis Company also manufactures these holders in its own shops.

To allow the drawing of a contrast with the reaction type brushes described above some of the other brushes in use on machines exhibited at the New York show are illustrated herewith. One of these is a new type brought out by the General Electric Company and shown in Fig. 6. In this the carbon brush fits loosely, and is free to slide radially in a frame, a number of which are clamped rigidly to the brush holding stud. Fastened into a copper strap, which is soldered to the top of the brush, is a flexible copper braid, which conducts the current to a lug which is bound under a thumb screw to the holder, one through the box in which the brush slides and the other through the spring. The simple H-shaped insulating clamp, by which the holder is attached to the brush supporting spider and the hole and set screws for the conducting lead, are also shown in the illustration.

Another device interesting because of its peculiarities is that used by the American Engine Company, and illustrated in Fig. 8, where one of the two brushes is raised to show more clearly the operating mechanism. The holders are clamped by a thumb nut to the stud, and the brushes slide radially in a box frame, and are forced down by a lug engaging the top of the brush, and attached to a rack, which is actuated by a gear, to which a tendency to rotate

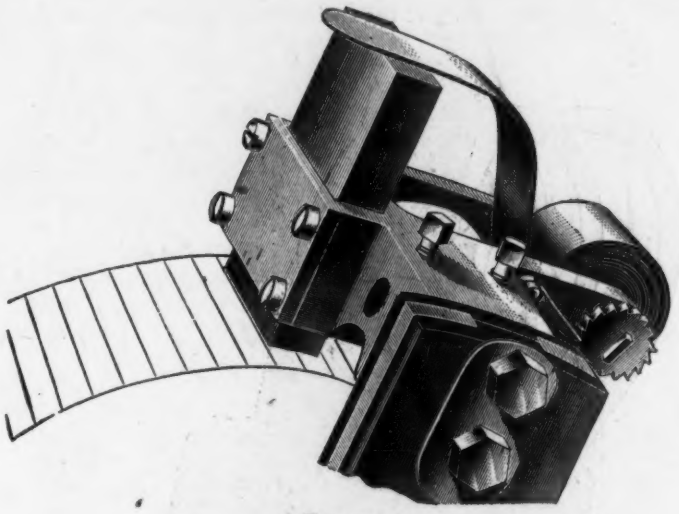


FIG. 7.

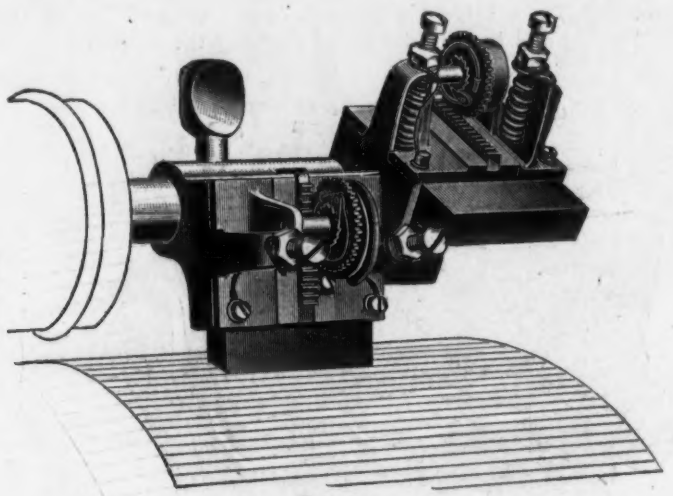


FIG. 8.

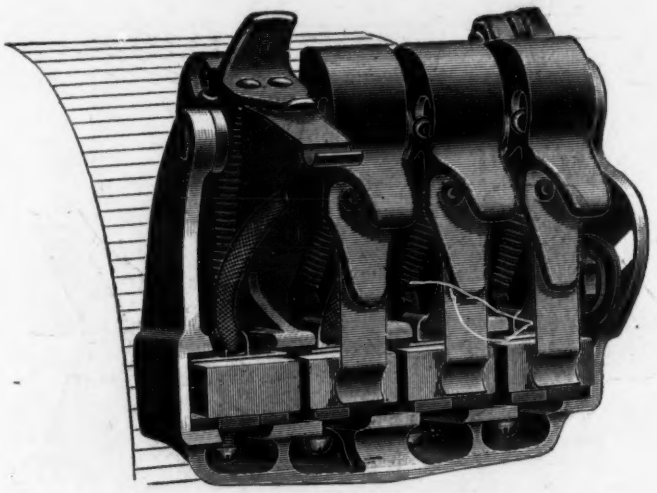


FIG. 9.

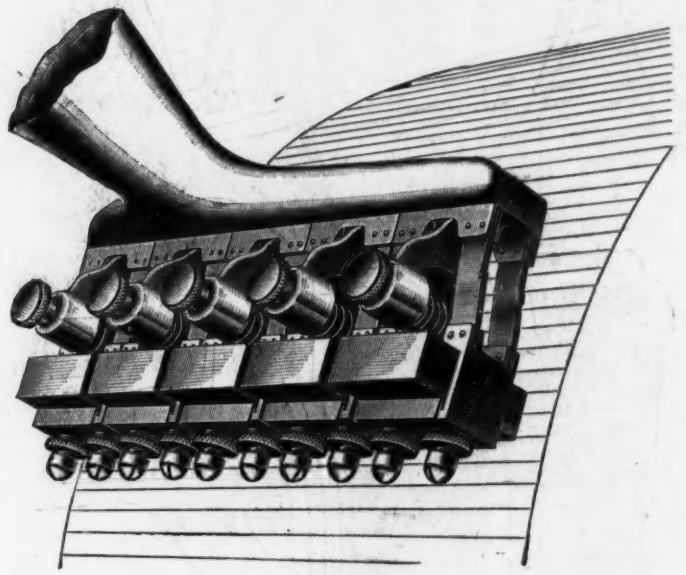


FIG. 10

to the rigid part of the holder. Tension is applied by means of a flat reinforced leaf spring, and is adjusted by means of a knurled nut on the thumb screw mentioned above. The under side of this nut is squared, and sets into the slot in the leaf spring, so that it not only cannot work loose by vibration, but the unscrewing of the thumb nut to remove the copper braid and the brush does not disturb the adjustment of the spring. There is also obviously no possible means of disturbing the position of the brushes or getting the various brushes of one group out of line with each other.

Another holder of interest is that shown in Fig. 7, and used on machines manufactured by the Card Electric Company. The carbon brush here also slides loosely in its holder and is forced against the commutator by a long leaf spring bearing directly against the top end of the brush. This spring is coiled up spirally, its inner end being attached to a drum fitted with a ratchet wheel and ratchet by which the tension can be adjusted, and fixed in such a way that it will not shake loose. An elongated rectangular nut on the face of the ratchet wheel is arranged to take a wrench when it is desired to adjust the tension. The current obviously has two paths is given by a spirally wound flat spring, very much like a clock spring. This also is retained in any position to which it may be adjusted by means of a ratchet and pawl, the ratchet in this case being held up by another spring. Two other helically wound springs press the cover of the box against the brush, screws and lock nuts being provided to adjust the pressure. A reduced resistance is sought by means of small flexible copper leads from the box cover to the frame. The American Engine Company also uses the reaction type of brush, which is obviously quite different from the one just described.

A holder particularly designed and adapted for the abuses and rough handling of street railway motor work is that used by the Walker Company on all its railway motors and shown in Fig. 9. In this the carbon blocks are clamped in copper frames, which in turn are connected by flexible copper braids to the body of the holder. Strong arms, the left hand one of which is shown raised, bear against the top of the carbons, and by means of helical springs force the carbons down against the commutator. When raised, the line of action of the springs crosses the pivot, so that

the springs hold the arms up as well as down. These arms shelter the copper braids and springs beneath them to a certain extent from blows from above.

A brush holder lately brought out by the Crocker-Wheeler Electric Company, and most admirably combining the good qualities of perfect flexibility radially with rigidity in all other directions and no sliding surfaces in the electric circuit, is shown in Fig. 10. Here the carbons are clamped by screws and lock nuts in separate boxes or frames, each of which is attached to the main casting of the holder by four parallel motion links made up of copper leaves. In the illustration it appears as though each link were made up of two strips, but in reality each link consists of many thin strips all riveted together, and to the base at one end and to the box at the other. These serve the purpose of giving flexibility in one direction, rigidity in the others, and carrying the current by low-

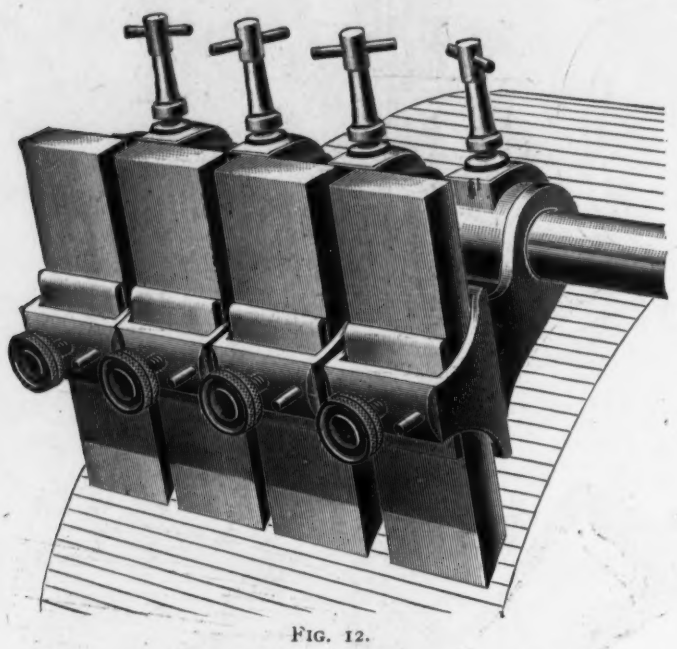


Fig. 12.

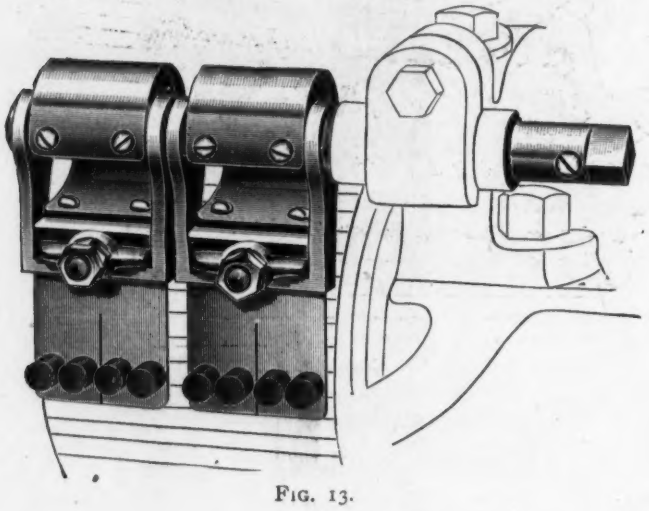


Fig. 13.

resistance joints from the box to the base of the holder. Pressure is provided by means of the helical springs shown with adjusting screws with knurled heads, a separate spring being provided for each brush.

An odd brush holder used on the elevator motors exhibited by Otis Brothers & Co. is shown in Fig. 12. These holders consist of copper plates attached to frames pivoted on the stud, and further attached to the stud by reinforced spiral leaf springs, which give the proper pressure. Each copper plate carries passing through it and soldered to it four round carbons, which constitute the brushes. The copper plates are split to give the pairs of rods a certain individual flexibility.

The only representative of the once widely used tangent brush exhibited at the show was that in use on the Fort Wayne machine, and shown in Fig 13. The holder is free to turn about the stud, and pressure is applied by a spring connecting it with a collar fixed on the stud by a set screw. The pressure can of course be adjusted by loosening this and rotating the collar one way or the other.

A type of holder in which the best results have been sought regardless of care and expense is that designed by Mr. A. Churchward and used on the machines manufactured by the Excelsior Electric Company. This is shown in Fig. 14. Here the brushes slide radially in a loose fitting box, and, to make sure of their free action, each brush is bound in a copper strap, which is riveted to it and finished. Projecting from the back end of the brush and attached to this strap is a long stud into which there is fastened a generously proportioned copper braid or "pig tail", by which the current is carried to the main casting of the holder. Surrounding this stud is a helical spring, the several springs of all the brushes in one holder being forced down by a frame with screw adjustment. To absolutely prevent heating of the springs and the reduction of their

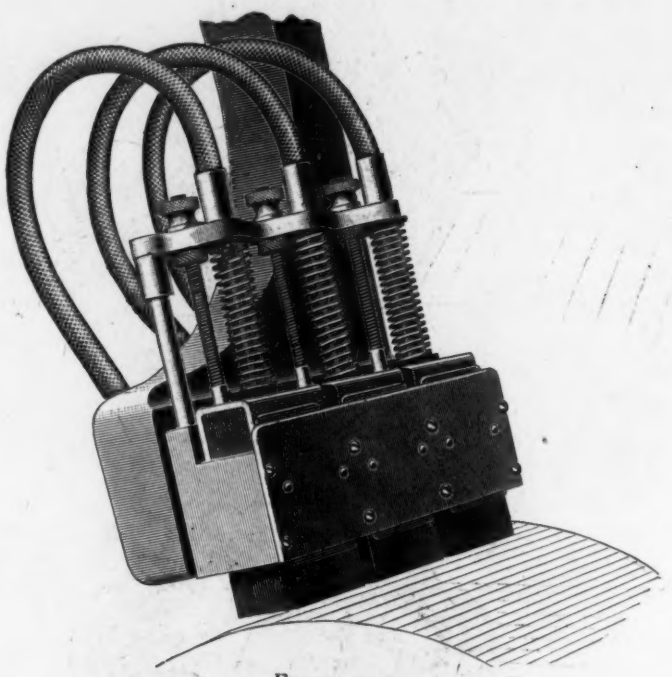


Fig. 14.

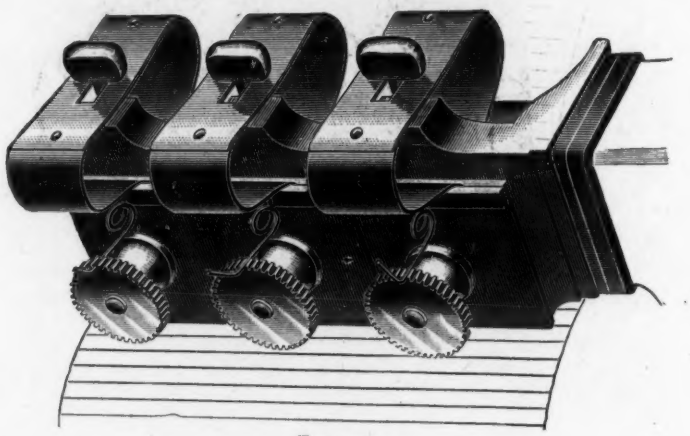


Fig. 15.

temper, fibre washers are inserted between them and the frame, so that no current can by any possibility pass through them. The construction of this holder is very substantial and the parts are finished with no little care, so that its action is very perfect, but it obviously cannot compare in point of first cost with some of the types mentioned above.

A peculiar holder is that shown in Fig. 15, and used on the motors of Sprague screw type elevators. Here no provision is made whatever for any following of the irregularities or eccentricities of the commutator surface, except the slight flexibility of the holder arm. The brushes are forced down against the commutator by the springs shown at the top of the illustration, which can be released by turning the thumb nuts a quarter turn and allowing them to slip through the springs. Once forced down the brushes are fastened firmly in place by clamps, which are locked against working loose by wire springs engaging the knurled heads.

of the clamping nuts. The question of commutator irregularities is intended to be solved by the simple means of keeping the commutator true, and it should be stated that this odd method appears to work very satisfactorily in practice.

The Two-Rate Meter System in Brooklyn.

BROOKLYN, N. Y., July 18, 1898.

To the Editor of The Electrical World:

SIR:—In reply to your inquiry as to why we have given the preference in Brooklyn to a test of the two-rate system in place of the Wright demand, I would answer as follows:

The Wright demand system is a difficult one to explain to the ordinary customer, and the fact that periodic adjustment of bills is made somewhat complicates matters for the company. In submitting the matter to several of our leading customers, and taking into account their comments, we decided that from the point of simplicity the two-rate system would have the advantage. We experienced no trouble at all in explaining to a customer that we can afford to make a cheaper rate during the period when the greater part of our machinery is not in use, since then we are not obliged to expend extra capital to supply the requirements; in other words, we are trying to keep our idle machinery in operation continuously, the same as are the Western Union Telegraph Company, the Long Distance Telephone Company, etc., etc.

Outside of the question of explanation to the customer, and taking the matter up from the standpoint of the company, there is a striking comparison between the actual two-rate system and those systems, such as the demand system, which are dependent for their rate modification upon the indication of the individual maximum load. Nothing can better express this than a letter which I have just received from a gentleman standing high in the electrical profession, and who has given a life-time thought to the question of meters and metering. He says:

"In those systems which depend for their modification of the rate of charge upon the ratio between the maximum current used at any one time, and the total record for any given period, we meet a system which is aimed primarily to discourage the use of large quantities of energy for short periods; and, secondarily, to encourage the use of small quantities for long periods. The prime tendency of this system is to discourage all load peaks and to encourage all who use small quantities for long periods. It is obvious that any system of this kind must be largely dependent upon the occurrence of local peaks coincidently with the station peak for its success.

"At first glance it might very reasonably appear that these theoretic conditions were the actual existent ones, but you have doubtless already ascertained by an analysis of your system that this is not the case. I have found as a rule that station peaks are primarily caused by a comparatively few large local peaks which are coincident, being superimposed upon a heavy load of fairly long continuance.

"In the two-rate system, on the other hand, we find the same tendency to beat down all peaks, provided they occur at a time when you do not want them; that is, you beat down or discourage all peaks which are coincident with your station peaks, and these are the only peaks which are objectionable to you.

"The two-rate system, therefore, beats down your station peak, but it does something else which is vastly more important. It directly encourages and stimulates all peaks which are not coincident with your local peak. It puts a premium on heavy burning at times when your station is lightly loaded, and it therefore not only beats down your station peak, but by the introduction of a lot of local peaks non-coincident with your station peak, it also tends to build up your average station line, accomplishing this by the introduction of a series of local peaks."

The General Electric Company has recently placed upon the market a double rate mechanical meter, in which the counting of the time of the single motor is transferred from one dial to the other. This transfer is made at predetermined times by a self-winding clock inclosed in the meter and kept in operation by the main current. We have now several of these in Brooklyn, and are adding others as fast as we receive them, connecting them to those customers presenting the worst cases, so as to give the system a thoroughly hard test at the outset. We have thus far received very gratifying results.

W. S. BARSTOW,
General Manager Edison Electric Illuminating Company of Brooklyn.

Disruptive Discharges, Leakage and Ohmic Resistance.

BY ALEX. JAY WURTS

In an editorial of THE ELECTRICAL WORLD for June 11 it is stated that the use of better materials has undoubtedly increased trouble from lightning, that a poorly insulated circuit offers opportunities for static charges to leak to ground; and in an editorial for June 25 there appears the following: "It must be remembered that such discharges are as a rule oscillatory, and that the impedance of, for example, a pencil lead with thousands of ohms resistance may be to such discharges less than that of a 1,000,000 cm cable 10 feet long. Very high ohmic resistances are nothing to discharges backed up by millions of volts, but the self-induction of a straight wire a few feet long may offer a great obstruction to their flow."

As my experience with disruptive discharges has led me to form entirely different opinions to those expressed in the editorials of THE ELECTRICAL WORLD, the following observations and experiments may be of interest.

Referring to the leakage of static charges from overhead wires, it hardly seems to me that the facts in actual practice warrant any such assumption. For example, in the early days of electric lighting and street railway work, when shellacked cotton insulation was used on surface-wound armatures, an immense amount of trouble was experienced by static discharges puncturing the insulation during thunder storms. With the better grades of insulation now used trouble from lightning has been enormously decreased; in fact, plants that used to shut down regularly in the early days now think nothing of running through thunder storms, although it must be admitted there is an occasional loss of a converter or an armature. But the impossibility of running poorly insulated apparatus through thunder storms in the early days indicates to my mind that this poor insulation did not leak the static charge. Furthermore, if it were possible to leak this charge, how is it that trolley wires and their feeders, when permanently connected to earth as they are, at many points, not only through the heavy copper conductors of motors and generators, but also through the non-inductive resistances of the lamp circuits, still give disruptive discharges, making it necessary to use spark gap lightning arresters? Why do not these wires leak their charge to earth?

A theoretical consideration of the subject may be of some assistance. We are accustomed to think of the atmosphere as being charged with static electricity during thunder storms, and that overhead wires become charged by this atmosphere; or, in other words, become electrically a part of it. To be a little more technical, the charged atmosphere is really an electrostatic field, and any conductors lying in this field, whether connected with the ground or not, will become charged by static induction, and will remain thus charged until the static field is removed. For example, if we have two parallel wires, say 50 feet apart, one of which is dead and the other charged with, let us say, 1,000,000 volts, a static field will be established around the first wire, which will itself then become statically charged and will remain in that condition until the static field has been removed, and if this static field be removed suddenly—that is, if the 1,000,000 volts potential be instantaneously removed from the second wire—the first will tend to discharge disruptively and will give off sparks to neighboring conductors. If the statically charged wire be of considerable length, and if one end be connected to earth, a portion of the charge will pass to earth through this connection, but the parts of the wire distant from the earth connection will still tend to discharge disruptively to neighboring conductors. And so it is, I think, with overhead wires during thunder storms. These wires are suspended in an electrostatic field; they are charged and remain charged until this field is removed, and this occurs only with the lightning flash. With every lightning flash, therefore, we may expect a disruptive discharge to occur from overhead wires. It seems to me that this theoretical consideration, as well as the facts which have been accumulated, disprove any possibility of leakage through weak insulation.

Now, as regards ohmic resistance, I desire to call attention to the following experiments:

Referring to the diagram, Fig. 1, resistance to the passage of disruptive discharges has been measured in the following manner: A static machine driven by an electric motor at a constant speed has been used to charge a battery of Leyden jars, the latter discharging across an initial spark gap B and then through two paths connected in shunt to each other, one of these being the resistance or object whose resistance it is desired to measure, and the other an adjust-

able spark gap A. When the disruptive discharges pass over B, and then indifferently through the object to be measured and the variable spark gap A, the length of the A gap may be taken as a measure of the resistance which the object under test offers to the passage of disruptive discharges. For example, in the diagram there is shown what is known as a double pole, "short gap" lightning arrester, which consists of two spark gaps in series, with a non-inductive resistance amounting to 120 ohms. With disruptive discharges passing at B at intervals of about ten seconds, the A gap being closed, the disruptive discharges naturally pass through the closed A gap, but as this A gap is opened wider and wider a point is reached at which the disruptive discharges pass indifferently through the lightning arrester or through the A gap. The two paths are then said to be balanced, and the length of the A gap may be taken as a measure of the resistance which this lightning arrester offers to the passage of these particular disruptive discharges.

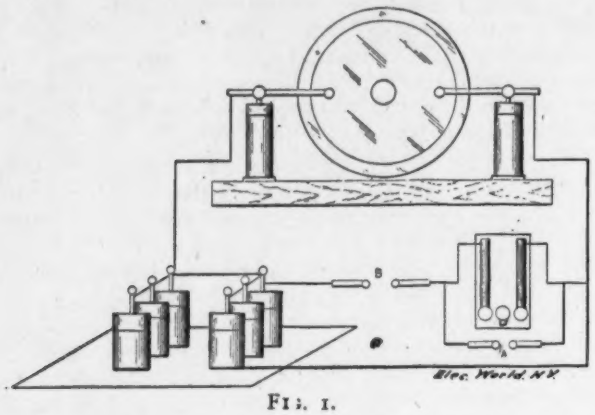


Fig. 1.

In the following experiments the lengths of A and B are measured in thirty-seconds of an inch. First, with a value of B equal to 12, comparative measurements were made between a short-gap lightning arrester having 120 ohms resistance and two gaps aggregating one-sixteenth inch air space, and a series of six spark gaps, aggregating eleven-sixty-fourths inch air space, forming the standard non-arcing metal lightning arrester. With the former the A gap, or equivalent gap, as it is often called, was found to have a value of 9, and with the latter the A gap was found to be only 2¾, thus showing experimentally that a non-inductive resistance of 120 ohms in series with two spark gaps offered about three times the resistance to the passage of disruptive discharges that six gaps offered without resistance in series. The above test was then verified by finding that three non-arcing metal arresters connected in series, making a total of eighteen spark gaps, would just balance a single short-gap lightning arrester.

Furthermore, it was noticed that the discharges which passed over the short-gap lightning arrester made a relatively small spark and a quite significant snap, compared with the larger sparks and loud reports which accompanied the passage of these discharges across the non-arcing metal lightning arrester. This observation seemed to me to be in line with the experiments above described, and indicated that the discharge was not complete, that the resistance did not allow the battery of Leyden jars to entirely discharge its contents; in other words, that the path consisting of two spark gaps in series with a resistance was in some way a restricted path, whereas, the observations made on the arrester with six spark gaps gave one the impression of an open or free path.

To verify this conclusion regarding the restricted path and the free path the following experiment was made: The A gap being removed, the two arresters—that is, the short gap and the non-arcing metal—were successively connected in series with a fixed B gap, and the rate of discharge determined—that is, the number of discharges per minute—the static machine being driven at a constant speed. The results obtained are given in the following table:

Test No. 1.

	Discharge Rate.		
	Number of Discharges.	Duration Minutes.	Rate per Minute
Non-arcing metal	50	5	10.0
Short gap	62	5	12.4
Test No. 2.			
Non-arcing metal	40	5	8.0
Short gap	55	5	11.0

By examining these results it will be observed that the rate of discharge for the short gap arrester was considerably greater than for the non-arcing metal arrester, and it seems to me that the reason for this may be found in the high resistance which the 120 ohms offers to the passage of these disruptive discharges. In other words, this resistance does not allow complete discharge of the Leyden jars; consequently, it requires less time to re-charge the jars, and the discharges ,therefore, occur more frequently; but the quantity of the static charge which passes through the arrester is relatively small. In service this feature is liable to cause a splitting of the discharge, one passing through the arrester and the other through the insulation of the system.

It will be noticed that the three times greater resistance of one arrester over the other, the difference in the size of the spark, the difference in the sound of the spark, the difference in the rate of discharge through the two arresters, all these observations support each other and indicate that ohmic resistance does greatly impede the passage of disruptive discharges.

May not the explanation be this? Allowing that the discharges are oscillatory, then each oscillation has to meet and overcome any ohmic resistance in its path, but with simple spark gaps the work which has to be done by disruptive discharges is simply to push aside the air in the spark gaps, and this being done by the first oscillation the passage is free for the succeeding oscillations. To help the imagination, I would liken the simple spark gap lightning arrester, which I have called a "free path" lightning arrester, to an empty water pipe having in it a glass diaphragm. With the first sudden on-rush of water the glass diaphragm is instantly shattered and the passage is free for all the water which may follow. On the other hand, the lightning arrester, consisting of a spark gap with resistance in series, may be likened to an empty water pipe having a glass diaphragm as before, but in front of it a strong steel diaphragm with a small hole in it. The first on-rush of water will break the glass diaphragm, but the resistance offered by the perforated steel diaphragm will still remain for all the water which may follow; and a further idea may here be added, namely, that the greater the amount of water the greater difficulty will there be in discharging the pipe through the small hole; and this seems to be the case with the restricted path lightning arrester, as is shown in the following experiment: Referring to diagram Fig. 1, it will be observed that any variation in the value of B will cause a corresponding variation in the volume of the discharge from the battery of Leyden jars. That is,

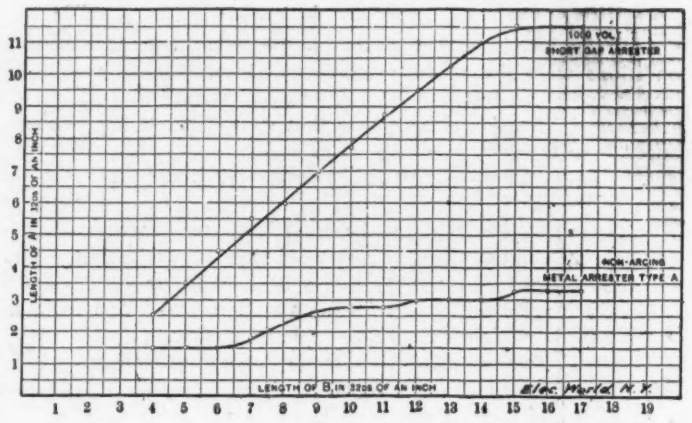

1000 VOLT SHORT GAP ARRESTER
NON-ARCING METAL ARRESTER TYPE A
LENGTH OF A IN 32ds OF AN INCH
LENGTH OF B IN 32ds OF AN INCH
Elec. World N.Y.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
1 2 3 4 5 6 7 8 9 10 11

Fig. 2.

if B equals 12, the discharge will be much greater than if B is equal to 3. Therefore, by varying the value of B the corresponding values of A may be determined for any lightning arrester. These values for the short gap and the non-arcing metal lightning arresters have been determined, and will be found plotted in diagram Fig. 2. Attention is called to the rapid increase in the value of A for the short-gap lightning arrester as compared with the slight increase in value of A for the non-arcing arrester as the value of B is increased; and if the discharges obtained from overhead wires during thunder storms are assumed to be of considerably greater volume than anything which can be obtained from a laboratory static machine, it will not require much stretch of the imagination to see that a lightning arrester consisting of spark gaps in series with a non-inductive resistance may offer great impedance to the passage of disruptive discharges when compared with the free path or simple spark gap lightning arrester.

The Chemistry of High Temperatures.*

The researches conducted by M. Henri Moissan, with the aid of his electrical furnaces, extend over a period of about five years, and have won for this distinguished chemist an additional title to take rank with the foremost exponents of scientific inquiry at the close of this century of science, so auspiciously inaugurated by the great discoveries of Gay Lussac and Sir Humphry Davy.

The application of the high temperatures attainable by means of the electric arc, for the purpose of producing physical and chemical effects, is by no means of recent date. Many important observations on the effects of electric heat were made already by Van Marum, at the close of the last century, and by Humphry Davy, the discoverer of the arc, at the beginning of the present one. In 1849 Despretz utilized the intense heat of the arc in various scientific investigations, and later Pichon, Siemens and Huntingdon, Cowles, Heroult, Grabau, Borchers, Acheson, Willson and many others either suggested or realized the employment of the electric furnace for various industrial purposes.

In all these cases, however, the materials subjected to the arc were directly exposed to and permeated by it. But, while this may not be objectionable in many industrial processes, the presence in the arc of vapors of carbon and other substances emanating from the electrodes, and the attendant electrolytic action, constitute a set of disturbing influences which will generally complicate the results, and render them liable to lead to erroneous conclusions.

Guided by these considerations, M. Moissan endeavored to devise a furnace which would subject bodies to the highest temperatures of the electric arc under simple and controllable conditions. He has constructed five modifications of such a furnace, which are characterized by the following features:

(1) A furnace consisting of a block of lime, hollowed out, and provided with electrodes in such a manner as to maintain the arc above the substance. The cavity is lined with suitable materials.

(2) A furnace of fine-grained limestone lined with alternate layers of carbon and magnesia, the former on the inside. This construction permits the use of higher temperatures than the preceding one, and is well adapted for receiving crucibles.

(3) A furnace provided with a tube of refractory material, passing horizontally through the cavity. This arrangement affords a heated space, which is accessible from without, and protected from the action of any gases existing within the furnace. When desired, currents of gases or vapors can be passed through the tube while it is being heated.

(4) A furnace in which the tube is given an inclined position, which permits a continuous operation; the charge is introduced at the upper mouth, while the products are removed or flow from the lower one.

This model was employed for preparing large quantities of pure products in a short time.

(5) A furnace with a larger number of electrodes and arcs.

By this means a considerable space can be evenly heated, and large amounts of material treated in one operation.

By thus excluding electrolytic action, M. Moissan was enabled to investigate the simple heating effect of the current. The temperature ranged from 2000° to beyond 3800° C. While it is not possible to give exact figures for the highest temperature attained, an idea of the conditions may be formed from the description of some of the experiments. The currents employed varied from 35 amperes at 55 volts to about 1600 amperes at 110 volts.

The results obtained by means of the electric furnace may be considered comprehensively under the following heads:

I. A series of researches on the fusion and volatilization of refractory bodies.

Various compounds and elements which are either infusible or non-volatile at the highest temperatures attainable by combustion were melted or vaporized when subjected in the furnace, Model 1, to an arc consuming 30 to 40 horse-power of energy.

Thus lime, magnesia, molybdenum, tungsten, vanadium and zirconium were readily fused, and lime, silica, copper, platinum, aluminum, boron, carbon and other refractory bodies volatilized.

II. In a second series of experiments a number of reactions, which can be effected at the highest temperatures only, were made the subject of investigation.

The carbonates of barium and strontium were without difficulty resolved into carbonic acid and the oxides. Those oxides which had withstood the de-oxidizing action of carbon at the highest temperature of ordinary furnaces were readily reduced by that element in the electric furnace; others, whose reduction by carbon in the wind furnace is difficult or incomplete, readily yielded their oxygen to the carbon under the action of the arc.

III. The study of the three allotropic modifications of carbon constituted a third extended series of experiments.

The most important, perhaps, and the one which has become universally known, is that ordinary charcoal may, by means of the electrical furnace, be converted into diamond.

When molten iron at 3500° is saturated with carbon and the mass then suddenly chilled on the outside, the enormous pressure produced in the interior will cause part of the carbon which separates to crystallize in the form of diamond. Both the transparent and the black (carbonado) varieties were thus obtained—the former in octahedra and cubes, as well as in fragments; the specific gravity of 3.5, the hardness and all characteristics corresponded to those of the native stone.

It is further shown that, at about 3000°, under ordinary pressure, all the modifications of carbon are converted into graphite, and various varieties of this (the ultimately stable form of carbon) were recognized and studied.

The reason for the infusibility of carbon under ordinary pressures was established to be due to the fact that it passes directly from the solid into the gaseous condition. Carbon was actually sublimed and the reactions of its vapor studied.

IV. There yet remains to consider the investigation of several new series of crystallized compounds belonging to the classes of borides, silicides and carbides.

M. Moissan has shown that these compounds, as a rule, have very simple compositions, and that, at the highest attainable temperatures, carbon, silicon and boron generally form but one compound with another element.

The silicides, like Acheson's carborundum, possess extraordinary hardness; some, as those of boron and titanium, appear to be even harder than the diamond.

Of the metals, some do not combine with carbon; others while dissolving it at very high temperatures deposit it as graphite before they solidify. A very large number of metals, however, form definite, crystallized carbides.

These M. Moissan divides in two classes; those which decompose water at ordinary temperatures, as, for example, the carbides of the metals of the alkalies and alkaline earths, of aluminum, cerium, etc.; and those which do not react in this manner, and which include the carbides of chromium and titanium.

It appears that M. Moissan was the first to produce the crystallized calcium carbide in the electric furnace. He has also exhaustively studied the action of the various carbides on water.

The Franklin Institute therefore awards the Elliott Cresson Medal to M. Henri Moissan, of Paris, France, for his work on the chemistry of high temperatures.

*The report of the Franklin Institute, through its Committee on Science and the Arts, on the investigations of M. Henri Moissan, with the electric furnace, Abstracted.

Telephones and Liquid Air.

Mr. Henry Norman, the well-known English journalist, in a recent article entitled "America Revisited in War Time," in the July issue of "McClure's Magazine," speaks as follows regarding the use of the telephone here and in England:

"The observant visitor to America must be impressed first with the remarkable development of what may be called applied intelligence. Not only is there an extraordinary fertility of invention, but also, what is perhaps more striking still, there is apparently an instant readiness on everybody's part to make use of the things invented. * * *

"From visit to visit, for example, I have observed a constant improvement in the telephone. The instrument has grown smaller, neater, more graceful, simpler, and easier to use. As it stands on an American desk to-day, it might be a flower-holder. In some of the best and most expensive parts of London to-day you cannot have a telephone put in your house at all. When you do, it is the ugly box arrangement of ten years ago. I call upon a journalist friend in New York. Upon his desk stands an elegant little apparatus through which he converses every afternoon with Washington and Chicago. In a London newspaper office you might as well look for a machine for making liquid air."

DIGEST
OF
CURRENT ELECTRICAL LITERATURE
AMERICAN AND FOREIGN
By Carl Hering.

Dynamos, Motors and Transformers.

ELECTRIC GENERATORS. Parshall and Hobart. Lond. "Engineering," July 1.—In this continuation of their serial (see "Digest," June 18) they discuss Foucault currents and hysteresis losses in cores. In smooth core armatures there may be considerable loss from Foucault currents in wires, and it cannot be accurately predetermined; the loss can be greatly diminished by subdividing the wire, which is illustrated by an example in which there were four wires in parallel, each 0.165 inches in diameter, and when these were replaced by nineteen strands of cable having the same cross-section of copper the total armature loss was diminished by one-third. In slotted armatures the conductors are more or less protected, depending on the magnetic density in the teeth, but even where this is low stranded conductors must sometimes be used; stranded conductors are open to the objections of increased first cost and of having 15 to 20 per cent. higher resistance for given outside dimensions; no oxidation or other coating of the surface of the individual wires is necessary in such stranded cables, as the contact resistance suffices. Eddy currents will also be found throughout all solid parts of the magnetic circuit, and it is therefore preferable to laminate them; in continuous current machines the disturbances are mainly local, but the losses near the pole faces may be large, depending chiefly on the depth of the gap as compared with the width of the slot opening; an increase of the gap from one-eighth to one-quarter inch in a certain case greatly modified the magnitude of the pole face losses; straight-sided armature slots produce greater losses in pole faces than those with overhanging projections, whereas, if they are completely closed, the loss is practically eliminated. In the neighborhood of conductors and coils where there is a high magnetic force all solid supports should be avoided unless of a high-resisting, non-magnetic material such as manganese steel; spool flanges could well be made of this material. Eddy current losses in the armature sheets depend on the square of the density of the flux, the square of the periodicity, and the square of the thickness of the sheets; also on the care with which the laminations are insulated; owing to the smaller amount of machine work smooth-core armatures are more apt to be free from parasitic currents in the core; the plates should be assembled without milling or filling, if possible; in one case the milling of the armature slots increased the core loss three times; tests of the core losses of a railway motor at various stages of manufacture are referred to by curves published in a previous installment. The hysteresis loss in the cores is then discussed, and some curves for railway motors are referred to; this loss in transformers will receive special consideration later; this loss may be from 1.5 to 2 times the theoretical value, owing, probably, to the flux taking a transverse path. In addition to considering the heating with reference to the radiating surface. it is sometimes useful to consider it on the basis of rate of generation of heat in watts per pound of material; the two following tables will assist in this; these

COPPER.

Current Density in Amperes per Square Inch.	Rate of Generation of Heat by Ohmic Resistance. Watts per Pound.					
	0 Degree Cent.	20 Degrees Cent.	40 Degrees Cent.	60 Degrees Cent.	80 Degrees Cent.	100 Degrees Cent.
500	.50	.54	.58	.62	.67	.71
1000	2.00	2.15	2.33	2.48	2.68	2.84
1500	4.40	4.74	5.1	5.5	5.9	6.2
2000	7.9	8.4	9.1	9.8	10.6	11.2
2500	12.3	13.3	14.3	15.3	16.5	17.5
3000	17.7	19.0	20.6	22.0	23.7	25.0

SHEET IRON.

Flux Density (Kilolines per Square Inch).	Rate of Generation of Heat by Hysteretic Resistance (and by Ohmic Resistance to the Extent to which Eddy Currents are Present).			
	25 Cycles	60 Cycles.	100 Cycles.	125 Cycles.
20	.10	.25	.44	.59
40	.27	.75	1.3	1.85
60	.56	1.5	2.8	4.0
80	.92	2.5	4.8	6 7
100	1.4	3.8	7.3	10.5
120	2.0	5.4	10.5	15
140	2.8	7.7	15.	22

should also be used in calculating iron losses at high densities; smooth-core armatures can be run at higher current densities than iron clad, owing to the better ventilation. The following table gives some rough figures for current densities used in various cases: in

	Amperes per Square Inch.
Small, high-speed armatures	2500 to 3500
Large " "	1500 " 2500
Small, low-speed armatures	1500 " 2000
Large, " "	1100 " 1600
Transformers with forced circulation of oil or air	800 " 1500
Large transformers immersed in oil or air	500 " 900
Small transformers immersed in oil or air	500 " 1100

small transformers the current density can be very much higher; large, properly designed transformers have a better regulation than is necessary; a rise of no more than 60° C. should be aimed at, even with large transformers. Insulating substances have a very large negative temperature coefficient; in a case in which the insulation was mica and cloth with the transformer immersed in oil, the average temperature coefficient between 20 and 80° C. was —0.8—that is, the insulation resistance increased 80 per cent. per degree C. decrease of temperature; the resistance to disruptive effects is, however, practically unimpaired, and the two should be carefully distinguished. Railway motors have an efficiency curve which quickly reaches its maximum and then falls off, and they can, therefore, not be used for long periods at full power without excessive heating. Arc dynamos have to be designed with a very low current density, but their efficiencies are very low; they recommend throwing them all out and installing well-designed apparatus. In constant potential dynamos the aim should be to have the electromagnetic and the thermal limits coincide; 40 or 50° C. rise in temperature during continuous running is generally considered entirely satisfactory.

COMMUTATION OF CONTINUOUS CURRENT DYNAMOS. Girault. "Bul. Soc. Int. des Elec.," May.—The reprint of a very long mathematical paper read before that society It is usually assumed that the current in the short-circuited coil should be equal in amount and direction to that which the coil must carry after it leaves the brush, but he claims that a more careful examination shows that this is far from being the correct and satisfactory condition, the true phenomena being extremely complicated He then discusses this at great length, and in considerable detail; no general conclusions are given.

This appears to be the same article which has been reprinted in "L'Ind. Elec.," and referred to in the "Digest," June 18; it is continued and concluded in that journal May 25, June 10 and June 25.

MAGNETIC LEAKAGE IN DYNAMOS. Osnos. "Elek. Zeit.," June 30.—A criticism of the recent article by Rothert (see "Digest," June 18). The latter claimed that the density of the lines of force is inversely proportional to the magnetic resistance of its path; this Osnos shows is not correct, and that one cannot speak of such a single density, as the number of lines of force and also the cross section are different in different parts. He furthermore objects to considering two independent leakage fields, as there is always only one, which is the resultant field.

RANGE OF MOTOR SPEEDS.—Lond. "Elec. Eng.," July 1.—A short answer to a request to state the range of speed between no load and full load, with a 1-hp and a 5-hp shunt motor The speeds are calculated and a variation of 9 per cent. is shown. Practically constant speed may be obtained by adding a compounding coil in opposition to the shunt coils, the number of series turns bearing to the number of shunt turns the same ratio as the resistance of armature and series coils bear to the resistance of the shunt coils.

MOTOR STARTING SWITCH.—Lond. "Elec. Rev.," July 1.—A brief, illustrated description of one made by King & Co.

ARMATURE WINDINGS. Rice. "Amer. Elec.," July.—Brief descriptions, with clear illustrations, of what he calls forced windings; he describes how to wind an armature which was designed for a multiple path winding so that it shall have a two-circuit winding.

INDUCTION MOTOR. Wiener. "Amer. Elec.," July.—A short article giving some tables and data for the construction of induction motors.

DYNAMO AND MOTOR TESTING. Radcliffe. "Amer. Elec.," July.—A short, illustrated article giving practical hints concerning the mounting, connecting and handling of dynamos and motors for the various tests made by the constructor.

Lights and Lighting.

NEW CARBON FOR ARC LAMPS.—Lond. "Elec. Rev.," July 1.—A note stating that Strauss has patented in Russia a carbon formed of 90 per cent. of very pure carbon and 10 per cent. of carburet of silicium reduced to very fine powder and agglomerated with pitch. He claims a saving in current of 25 per cent. and a light of richer tint and greater intensity; the duration is 360 hours, which he hopes to increase to 1,000. (This does not seem to have been confirmed yet).

REGULATING MAGNETS IN ARC LAMPS. Weil. "Elek. Zeit.," June 30.—A reprint of a long paper in which he describes

and discusses mathematically the action of the regulating magnets in a certain arc lamp.

INCLOSED ARC LIGHTING. Hallberg. "Elec. Eng.," July 14.—A short article on the proper handling of such lamps; he shows that much trouble which is experienced could be avoided if those who sell and use such lamps knew more about their operation and details. He shows how a properly designed lamp may be completely ruined by too strong a current or by the arc being too close to the neck of the inner globe, this being the most frequent cause of trouble; he describes how the lamp will appear when this has been the case, and how it can be repaired, although he recommends sending it back to the makers.

VACUUM TUBE LIGHTING.—"Prog. Age," July 1.—An illustrated description of the Moore system as exhibited in a recent exhibition in New York.

ILLUMINATION OF THE TRANS-MISSISSIPPI EXPOSITION.—"West. Elec.," July 9.—A number of illustrations, with a brief description, showing the lighting effects.

Power.

DYNAMOS DRIVEN BY GAS ENGINES.—Lond. "Elec. Rev.," July 1.—Referring to a recent editorial in the "Elec. World," stating that in America producer gas is used very little, it is shown that in England this gas is used very much; the record is 650 watt hours at the switchboard per pound of coal, as compared with 150 to 300 in America. It is thought that direct driving with a flexible coupling, allowing a variation of 180°, is required; there should be a fly wheel on each side of this coupling; a strong helical spring is thought to be better than a flat spirally wound spring of the clock type; the objections to irregularities in the speed lose much of their force when more than one engine is at work; the engine should not be fully loaded, so as to have numerous idle strokes; roller bearings are recommended.

POWER STATION AT PORT DUNDAS.—Lond. "Engineering," June 24.—An illustrated description of this new power house which is being erected by the municipality.

STEAM-USING PLANT.—Lond. "Elec. Rev.," July 1, and Lond. "Lighting," June 30.—A reprint (begun in the latter) in full of his recent Muncipal Elec. Ass'n. paper, containing numerous tables of data.

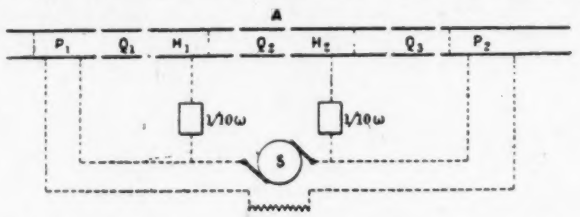
INCLINED ELEVATOR.—"Elec. Eng.," July 7.—An illustrated description of one which has recently been introduced in a large store in New York city.

BLAST FURNACE GAS FOR MOTIVE POWER. Greiner. "Prog. Age," July 1.—A reprint of a paper referred to in the "Digest" June 4 and 18.

SIZE AND PITCH OF SMALL PROPELLERS.—"Amer. Elec.," July.—Some tables and data for determining the power, diameter and pitch of the propellers for small boats.

Traction.

RAIL RETURN LOSSES. Vigneron. "L'Eclairage Elec.," June 25.—A description and discussion of a new method which he proposes for confining the return currents to the rails. The object is to keep the loss of voltage in the rails below 5 volts; the theory of the loss is discussed analytically, and he shows that if boosters are placed at certain points along the line, which will raise the voltage a certain amount proportional to the current, then this result will be accomplished; the rails are cut at these places and the booster inserted, driven by a shunt motor from the line circuit. Refer-



ring to the adjoining cut, P_1 and P_2 represent the ends of the cut rails at one of these places; Q_1, Q_2 and Q_3 are short, insulated sections having a length less than the distance between the axles of the cars; H_1 and H_2 are sections having a length greater than the distance between the extreme axles of the longest train; S is the booster for raising the voltage, the brushes being connected as shown, and a resistance of 0.1 ohm being inserted in the branches leading to H_1 and H_2; the exciting current is obtained from the rails as shown, and the booster is run on the rising part of its characteristic. A numerical example is worked out.

MECHANICAL TRACTION IN PARIS.—"L'Ind. Elec.," June 25.—The Omnibus Company, in Paris, has decided to use mechanical traction on about a third of its lines. On one of these air compressed to 80 kg per sq. cm. will be used, while the other will be run with rapidly charged accumulators, of the Tudor and of the Blot types.

FRANKFORT-o-M.—"Elek. Anz.," June 19 and 27.—A reprint of a description of the electric railway system in that city in Germany, to which other references have already been given. The trolley system is used outside of the city, while inside accumulators are used. The current is obtained from the alternating current lighting station after transformation into a direct current at substations.

BUDAPEST.—Lond. "Elec. Eng.," July 1.—A note stating that this city, with 600,000 inhabitants, is now the only one in Europe where animal traction, "over lined way," has been entirely given up.

ACCUMULATOR TRACTION. Hauswald. "L'Eclairage Elec.," June 25.—A French translation of the German paper noticed in the "Digest" February 12.

ELECTRIC VEHICLE.—"L'Ind. Eec.," June 25.—An illustrated description of the Elieson carriage, made in England.

OVERHEAD LINE FOR RAILWAYS. Pepper. "Jour. Frank. Inst.," July.—A reprint of a recent paper read before that Institute, in which he gives general instructions and data for the overhead line construction of electric railway systems.

WATERLOO AND CITY UNDERGROUND RAILWAY.—"Railway World" (London), reprinted in "Elec. Eng.," July 14.—A short, illustrated article on this short underground electric railway in London, which has just been completed; it runs in a deep tunnel, which passes under the river Thames, connecting the Waterloo station with the Mansion House.

ARGENTINA. Wardlaw. "St. Ry. Jour." (Int. Edit.), July.—A short, illustrated article on the electric railway development in that country; a list of the principal lines, with the number of passengers carried last year, is given. The electrical business is more active there now than at any previous time, and there are projects to equip all the street railway lines in Buenos Ayres with electric power.

Installations, Systems and Appliances.

METERS WITH VARYING CONSTANTS. Lux. "Zeit. fuer Beleucht.," June 20.—A short, illustrated article describing a method which he suggests by means of which the registering of the meters is so varied that their readings will be directly proportional to the load on the station at each moment; thus the charge per unit becomes a variable one, depending on the time when the current is used. The principle is independent of the construction of the meter and the connections are illustrated for three different kinds of meters. The illustrations show a shunt circuit tapped from the mains and in this circuit is an ampere meter and an adjustable resistance; in this shunt circuit is claimed that there will always be flowing a certain definite fraction of the current in the main circuit; this small current is led in series through all the meters, or at least through those branching from one main branch. (This does not seem to be correct, for on a constant potential system a constant current will flow through that circuit, which is independent of the main current; to give what he desires this auxiliary circuit should be branched from two points of one of the two mains or feeders, between which no current is led off; his arrangement seems, therefore, to be merely a suggestion.) This shunted current is then passed around the coils of the meter, thus changing its constant. The advantages claimed are that this current regulates itself, and is not adjusted or under the control of the central station.

HIGH VOLTAGE INCANDESCENT LAMP SYSTEMS. Passavant. "Elek. Zeit.," June 30.—A brief abstract of a recent paper. The advantages of raising the voltages to 200 or 250 are that the doubling of the voltage will increase the capacity of the distribution system fourfold; that it may be extended over greater distances; that the installations in dwellings are cheapened and simplified, one for an installment of 100 lamps, for instance, being reduced 30 per cent. in cost; that the reliability of the whole installation is increased, and that the lighting dynamos, being coupled two in series, may then be used for railway purposes. It would cheapen the cost of the electric light, and therefore extend it; it is not thought to be more dangerous, but on the contrary, even safer, because the higher voltage will require that the work be more carefully done, as every fault will soon make itself known; it is much safer than gas, which it is claimed should no longer be used in dwellings and factories.

STANDARDIZATION OF APPARATUS. Modulus. Lond. "Elec.," July 1.—A short correspondence on the recent suggestions of Wordingham (see "Digest," July 9). It is claimed that the latter did not consider the subject from the dynamo builders' standpoint; he thinks that the latter's suggestion to standardize in terms of the output is at present impossible, and will probably never be obtained; the steam plant completely controls this, and uniformity in the latter is not likely to to be reached, as the conditions are different according to the location. He urges making the specifications more elastic and considering alternative tenders more favorably.

MORLEY.—Lond. "Elec." and "Elec. Eng.," July 1.—An illustrated description of this 2000-volt alternating current station, having about 3000 lamps of 8 candle-power attached.

CENTRAL STATION ACCOUNTS.—Lond. "Elec.," July 1.—An analysis of the accounts of the St. James station in London.

METER TESTS. Ennis. "Elec. Eng.," July 7.—A short article on his recent tests of the meters of a station about which there was great complaint. The testing table, with all the connections, is shown, the results are described, and some of them given, showing that many of the meters were badly in need of attention and recalibration; the chief cause for trouble was the unintelligent care which had been given them, while some of it was due to the meters themselves. As a result of his investigations he recommends that all meters should be tested and adjusted if necessary when purchased,

each meter should be kept securely sealed, it should be tested on several loads, more attention should be given to the fusing of the meters, periodic cleaning should be insisted upon, and every meter should be tested at least once a year. The average results were calculated as follows: The error for each load was multiplied by the number of lamps composing that load, and the sum of these products were divided by the sum of the separate loads; the average error of all the adjusted meters was 0.22 per cent. slow.

THREE-WIRE VS. HIGH POTENTIAL SYSTEM. Wagner. "Elec. Rev.," July 9.—A very short article suggesting a combination of the two systems. There is not much difference in first cost between the mains for the three-wire [illegible]-potential system and the transformers and high-potential distr[illegible]ng mains; the Edison feeders for the same distance, however, cost 31 times as much as for the alternating current at 1100 volts, 125 times as much 2200, or 500 for 4400 volts. He therefore suggests using a high potential alternating current in the feeders and transforming it down for the mains.

BALTIMORE. Fairchild. "Elec. Eng.," July 7.—In the present installment of this long serial he gives brief descriptions of some of the lighting plants.

PARIS. Bayly. "Elec. Rev.," July 9.—A brief description of the Edison central station in that city.

Wires, Wiring and Conduits.

HIGH VOLTAGE ACCESSORIES.—Lond. "Elec. Eng.," July 1.—Well-illustrated descriptions of some new accessories made in England, for 200-volt systems.

Electro-Physics and Magnetism.

CATHODE AND ROENTGEN RADIATIONS. Swinton. Lond. "Elec.," July 1.—The conclusion of the long abstract of his Royal Institution lecture (see "Digest," July 9). He discusses the causes of the effects exhibited in a tube in which both the anode and the cathode can be altered independently in position; a curve shows the voltages required to cause a discharge to pass through the tube with varying positions of the anti-cathode; with a forward movement there is at first a gradual increase in the length of the alternative spark, which is followed by a very sudden increase and then by a more gradual one; another curve shows the same thing for the movable cathode, and in this case the less the distance the less is the length of the alternative spark; but the distance is not the determining factor, as it is more than counterbalanced by a very important factor, the position of the cathode relatively to the glass walls of the tube. The greater the resistance of the X-ray tube the greater the velocity of the atoms from the cathode rays, and the more penetrative are the Röntgen rays; furthermore, the supply of atoms appears to be of great importance, for if penetrative Röntgen rays are desired the access of atoms to the cathode must be restricted; if only a few atoms can get to the cathode they are projected with great velocity. The area of the anti-cathode plate was investigated by means of pin-hole photography, and several results are shown for different distances between the cathode and the anti-cathode. He shows that the photographic effect of Röntgen rays is relatively very feeble; he compared the X-rays, screened with black paper, with the light from a standard candle, and found that with the tube he used, which was a very good one, there was less than one-sixtieth of the photographic power of one standard candle. The true nature of the Röntgen rays is briefly discussed; it is now becoming more and more certain that cathode rays consist of negatively charged atoms traveling at an enormous velocity. Calculations show that the rise of temperature due to the impact on the anti-cathode plate is 50,000,000,000° C., but this is based on the probably erroneous assumption that the specific heat remains constant; there is, however, a sufficient margin to say that the temperature is enormously higher than that of the arc; it is thought that Röntgen rays are produced in some way by the sudden removal of velocity from the atoms which form the cathode rays.

POLARIZATION OF ROENTGEN RAYS. Graetz. "Wied. Ann.," No. 6; abstracted briefly in Lond. "Elec.," July 1.—He endeavored to produce polarized X-rays by letting the cathode rays impinge on crystals, but found that even with this most powerful means polarized X-rays could not be produced.

INTERFERENCE AND ELECTROSTATIC DEFLECTION OF CATHODE RAYS. Jauman. "Wied. Ann.," February; abstracted at some length in "L'Eclairage Elec.," June 25.—He repeated and completed his experiments, showing interferences in the blue cathode light, which he describes.

DISCHARGE OF A LEYDEN JAR. Swyngedauw. "L'Ind. Elec.," June 25.—A reprint of an Academy note. He discusses the discharge of a jar through the circuit of two coils in series, and finds that the maximum potential at the terminals of the double coil is the sum of the two maxima at the terminals of each. He measured the potentials by the spark method.

RESONATOR. Oudin. "L'Ind. Elec." and "L'Eclairage Elec.," June 25.—A reprint of an Academy note. Some years ago he showed the principle of the increase of voltage of high frequency currents by means of resonance; the first apparatus has since been modified, and he now describes the present form and the electric discharges produced.

GLASS AS A CONDUCTOR. Vosmaer. "Electra," June 18; abstracted briefly in the Lond. "Elec.," July 1.—According to Maxwell's theory, conductors should be opaque to light unless they are electrolytic conductors; if glass is a conductor at high temperatures it must be regarded as electrolyte. He describes an experiment illustrating the conductivity of glass. Two electrodes terminating in glass rods, connected to a high-tension transformer and heated in a Bunsen burner, will have an arc formed between them; the arc keeps the rods at the conducting point; if the electrodes are separated a spark discharge sets in and on further separation there will be a brush discharge.

RESISTANCE OF STEELS. Le Chatelier. "L'Eclairage Elec.," June 25.—A reprint of an Academy paper in which he gives the results of a systematic investigation of the effect which different ingredients in the steel have on its resistance; the samples used were the same as those investigated by Mme. Curie in her recent researches on the magnetic properties of steel. The specific resistances are given for a number of samples, having different proportions of carbon, manganese and silicon. The resistance increases quite appreciably with the percentage of carbon, the increase averaging 7 microhms for 1 per cent. of carbon in weight, or 1.5 microhms per 1 per cent. of the carbon atoms per 100 atoms of iron and carbon. The mean increase was 14 microhms per 1 per cent. of silicon in weight or 7 microhms for one atom of silicon per 100 atoms of the alloy, the increase, therefore, being much greater than for carbon; he infers that this element is therefore combined with the iron chemically. For manganese the increase is considerable, but, as with the magnetic properties, the resistances of the same sample may be very different; there is a general increase of about 5 microhms for 1 per cent. in weight or in atoms. Nickel also increases the resistance quite appreciably, and, as with manganese steels, there are two varieties, having different magnetic and resisting properties; the increase in resistance is extremely variable; for quantities less than 5 per cent. the increase varies from 3 to 7 microhms. The effect of chromium, tungsten and molybdenum is very slight, and could scarcely be measured for amounts less than 3 per cent.; he believes these do not form definite combinations with the iron.

ZEEMAN EFFECT. Corbino. 'L'Eclairage Elec.," June 25.—A translation in abstract from the Italian of an article on Cornu's interpretation of this phenomenon.

MAGNETIC SUSCEPTIBILITY OF LIQUID OXYGEN. Fleming and Dewar. Lond. "Elec.," July 1.—The first part of a reprint of a Royal Society paper giving the results of measurements made to determine whether oxygen had a constant susceptibility or whether this is altered when subjected to different magnetizing forces, as in the case of ferro-magnetic substances. The method they use was based on the fact that if a body is placed in a variable magnetic field it is subject to a mechanical force tending to displace it in the direction in which the field varies most rapidly; they obtained the difference in the susceptibilities of liquid oxygen and air; some of the results of the observations, but no conclusions, are given.

Electro-Chemistry and Batteries.

REGENERATIVE ZINCING PROCESS.—Lond. "Elec. Rev.," July 1, reprinted without the illustration in "El'ty" (N. Y.), July 13.—A brief, illustrated description of the Cowper-Coles process. The chief difficulty in electro-zincing is to keep the electrolyte in working order, as less zinc is dissolved than is extracted; this he overcomes with the use of zinc dust, which is mixed with coke or sand, through which the liquid is made to filter by means of pumps, and in this way the free acid is neutralized and the bath is kept free from impurities, which latter were one of the chief causes leading to the formation of zinc sponge. The electrolyte consists of 40 oz. of zinc sulphate per gallon of water, and has a specific gravity of 1.1770; the current density is 17 amperes per sq. ft., and the E. M. Fs. 6 volts.

CHROMIUM STEEL. Placet. "L'Ind. Electrochimique," abstracted briefly in "L'Eclairage Elec.," June 25.—A brief description of his process in which he deposits chromium electrolytically on the iron and steel objects, which are then submitted to a process of cementation by which the surface so treated becomes extremely hard, while the internal parts retain their previous qualities; the deposits are made of alternate layers of iron and chromium. This is all the information that is given in the abstract.

ALUMINUM INDUSTRY.—Lond. "Engineering," July 1.—A short article on this industry, giving data regarding the production and describing the various uses.

CALCIUM CARBIDE AND ACETYLENE.—Lond. "Elec. Rev.," July 1.—A brief abstract of a recent lecture by Lewes and some notes on patents.

ACCUMULATOR CONSTRUCTION. FitzGerald. Lond. "Elec. Eng.," July 1.—In this continuation of his long serial (see "Digest," June 11) he further discusses the formulas in which the unit of service is taken as a basis in designing a cell, illustrating them with examples.

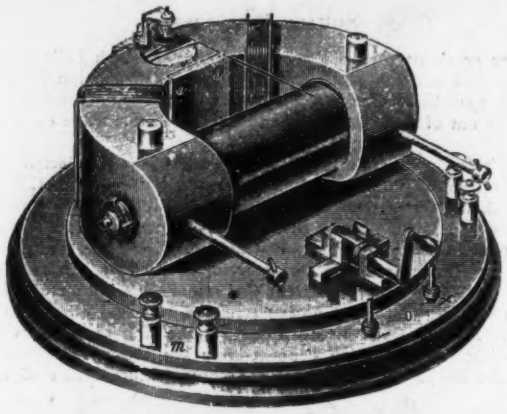
Units, Measurements and Instruments.

ABSOLUTE ELECTROMETER. Deprez. "L'Ind. Elec.," June 25, "L'Eclairage Elec.," June 25, and "L'Elec.," July 2.—A short Academy paper in which he suggests a new form, claiming that the usual electro-dynamometer is not an absolute instrument, because it requires a knowledge of the earth's magnetism where it is used; his form is claimed to be absolutely exact. A torus of revolution is made by revolving any closed figure around a vertical axis, and around this torus is wound a perfectly regular solenoidal circuit, consisting of any number of layers of wire; before winding this wire there is introduced into the interior of the torus a cylindrical coil with a circular base covered with any desired number

of regular windings; the only conditions necessary are that the axis of revolution of this coil is parallel to that of the torus, so that all the windings are parallel to the diametric plane of the torus; the inner coil should, furthermore, be movable around an axis of rotation located in this diametric plane, which is perpendicular to the axis of revolution of the torus and to the axis of the inner coil, and should pass through its centre. When these conditions are fulfilled the turning couple is calculated by a simple formula, which he gives.

ABSOLUTE ELECTROMETER. Perot and Fabrey. "Jour. de Physique," June; abstracted in Lond. "Elec.," July 1.—They describe the latest form of their absolute electrometer for measuring small voltages. It is of the attracted disc type, the distance between the discs being extremely small, from 0.1 to 0.03 mm, which is measured and maintained by an optical device based on the reflection of rays and interference fringes. Very small E. M. Fs. can thus be measured (but how small is not stated in the abstract).

APPARATUS FOR MEASURING MAGNETIC QUALITIES. Kath.—In the "Digest" last week an abstract of this article was published, but by an error the wrong cut was reproduced; the following is the one to which the description applies. The cut



which was reproduced last week shows the auxiliary apparatus and connections of this same apparatus; the two resistances shown are those for regulating the currents, the large circle at the bottom being the measuring apparatus itself, a view of which, without the cover, is now shown.

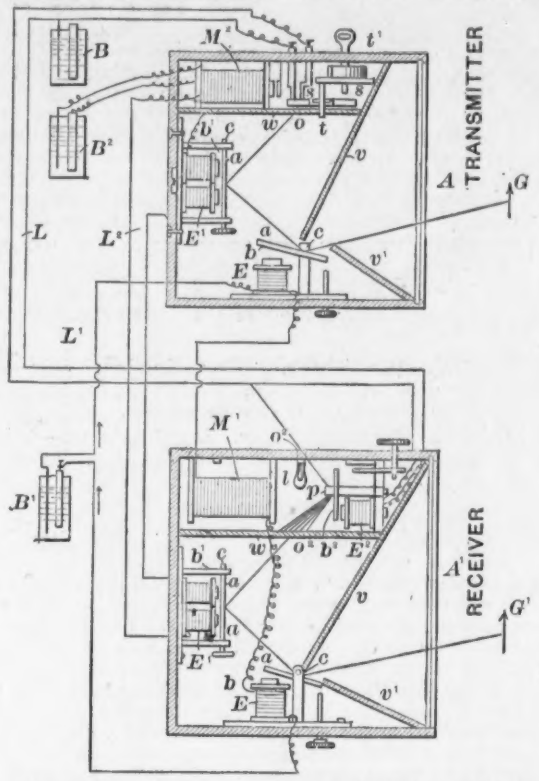
ONE-VOLT STANDARDS.—Lond. "Elec.," July 1.—A very brief, illustrated description of the Hibberd standards, which are now in the market. The recovery of these after accidental short-circuit is as rapid as that of the Clark cell; the temperature error is practically negligible, being considerably less than 0.01 per cent. per degree C.; the E. M. F. at 16° C. was 0.9993, and at 31° C. 1.0004; the cells can be made so as to give exactly one volt for any specific temperature. The cell is made of a zinc rod immersd in a zinc chloride solution of 1,380 sp. gr., separated from the mercurous chloride and mercury by a porous partition.

METER.—Lond. "Elec. Rev.," July 1.—A brief, illustrated description of an alternating current motor-type meter, measuring watt hours, made by the Electrical Company. Also a description of their latest arc lamp for both direct and alternating current.

Telegraphy, Telephony and Signals.

TRANSMITTING IMAGES.—"Electro-Techniker," June 15.—A short, illustrated description of the Szczepanik apparatus, about which so much has been said in the papers lately; several brief descriptions have already been referred to (see "Digest" April 9 and 23, May 7). The principle is that the image is divided into points which are transmitted and reproduced in such rapid succession that the received image is seen in its entirety. In the accompanying cut, the upper part shows the transmitter and the lower the receiver, the image transmitted being the arrow G; the rays (presumably first passing through a lens, which is not shown) fall on a mirror which is oscillated magnetically around an axis, and from here they are reflected by another oscillating mirror, whose axis is perpendicular to the first one; these mirrors are what are called line mirrors, and each separates the image into lines, the two together separating it into points, which are then reflected on to a selenium apparatus S, the cells of which are altered in resistance by the intensity of the light; this selenium apparatus is made of a sheet containing numerous insulated selenium cells, which are revolved by clockwork, so that new cells are continually being presented to the rays; the variable currents thus produced are sent through the line. The receiver has two similar line mirrors, which oscillate synchronously with those in the transmitter; by means of the electromagnetic apparatus E^2 the varying line current operates a small opening (referred to by a letter not on the figure), making it larger or smaller according as the current increases or diminishes; behind this screen there is a light 1 or a slit admitting daylight; the rays passing through this slit then fall successively on the two oscillating mirrors and are reproduced on the final screen in the form of a succession of points of light, which follow each other in such rapid succession that the whole image is seen at once. This is only for transmitting white light; when color also is desired he is said to use a prism, which decomposes the light from the original picture into its fundamental colors, which are then reproduced by another prism in the receiving apparatus, but this is not described.

The Lond. "Elec. Eng.," July 1, in a brief reference to his invention, states that selenium is affected by light in two ways; there is a change in the electric resistance, which is what is desired, but there



is also a spontaneous change in the conductivity which is beyond calculation, and which is caused by molecular and chemical changes in the selenium, which arise as soon as the current passes through the cell.

CHARGING ACCUMULATORS FOR TELEGRAPHY. Brunelli. "L'Elettricista," April 1; translated into French in the "Jour. Télégraphique," June 25.—An article on the calculation of a primary battery for charging accumulators. Accumulators are preferred, as a single battery of these will simultaneously operate numerous telegraphic circuits, while with primary batteries there is usually one for each circuit. He discusses the relations mathematically and develops a formula which shows that the ratio of the main battery current to the current in each individual circuit is equal to 1 + (n—1) times the ratio of the internal resistance to the sum of the external and internal resistance; n is the number of circuits; from this, and from the largest variation allowable for the relation between the individual currents and the main battery current, the internal resistance which the battery may have can be calculated, and from this the number of cells in multiple which are required. This is then applied to the primary and secondary cells usually used for telegraphy in Italy, the current for the telegraphic circuits being taken as 14 milli-amperes; he thus finds that a telegraphic circuit in which this current is produced has a resistance equal to 64 times the number of cells required; the E. M. F. is one volt, and the internal resistance 7 ohms per cell; for the Gandini accumulator, having a diaphragm, which is the one used, the internal resistances is 0.1 ohm, and he shows that the voltage, when accumulators are used, can be reduced 10 per cent. for each circuit; moreover, the currents, when twenty circuits are connected, are each practically equal to that in a single circuit. He then discusses the problem of calculating the number of primary batteries required to charge accumulators; the telegraphic current for each circuit is equal to a continuous current of 0.001 ampere, flowing continuously, after allowing for the intermittent nature of the working current; the voltages are different, depending on the circuits. In many of the smaller stations it is advisable to charge with primary batteries, as less apparatus is required; the difficulty involved is that the cells are unequally discharged, owing to the different voltages required for the circuits; the most rational solution is to make as many connections with the charging primary battery as there are branch circuits leading from the accumulators to the telegraphic circuits; this arrangement has not yet been tried; 3.5 cells are required for charging each accumulator; an example is worked out for a case in which there are twenty-five circuits, and a table is given for facilitating the calculations; by merely multiplying the required voltage by a certain factor given for each current the number of primary cells required is given directly; in this method no further manipulations are required, as the cells are all permanently connected.

SIGNALING WITHOUT CONNECTING WIRES. Edser. Lond. "Elec. Eng.," July 1.—The continuation of his long article (see "Digest," July 2). The following analogy, which he gives among other things, may assist in giving some idea of the way in which electromagnetic disturbances are propagated through the

ether according to Maxwell. Imagine a chain consisting of alternate links of iron and copper insulated from each other; if a current is started in the first copper link it will magnetize the next iron link which is threaded through it, and this will generate a current in the next copper link and so on, thus showing how signals could be transmitted to a great distance without any electrical connection in the usual sense of the word; if each copper link, instead of being continuous, was broken and the two ends connected to a condenser, and if it is assumed to be a perfect conductor and the iron to have no hysteresis loss, there will be no energy dissipated, the whole of the energy being transmitted along the chain; an infinite number of such chains between two points forms a rough model of Maxwell's ether. In his article he determines roughly the conditions necessary for the so-called wireless telegraphy; the general principles underlying the rival methods will be considered in his next installment.

SPECIAL TELEPHONE APPARATUS. West. "Elek. Zeit.," June 30.—A brief abstract of a recent paper describing telephone apparatus to be used in connection with high voltage installations and for mines; also a protecting fuse against strong currents.

TELEPHONY. Wietlisbach. "Elec. Eng'ing," July.—Reprints of two chapters from his book on telephony; the first is on the central office and the second on telephone service.

BALTIMORE. Fairchild. "Elec. Eng.," July 14.—A brief description of the exchanges of the Chesapeake & Potomac Telephone Company, in that city.

Miscellaneous.

OXYGEN FROM THE AIR. Claude. "L'Ind. Elec.," June 25. A short article on electro-thermics and the work of Linde. He shows the great value which a process would have for separating the air into its two constituents, and the effect which such a process would have on the electro-thermic industry. The Linde process of liquefying air is an absolutely closed cycle, and in this process the oxygen of the air liquefies first and evaporates last; by liquefying the air, therefore, and allowing it to expand again, a cycle of operations which involves the loss of very little energy, the nitrogen may be separated from the oxygen; in this way 5 cu. m. of oxygen were produced per hour per horse-power, according to d'Arsonval; this is about fifty times as much in weight "as the same hp-hour transformed into heat is able to produce from carbide of calcium;" at 1 cent per hp-hour this is greatly less than the lowest cost at present of oxygen, which is 16 cents per cu. m. Linde has already applied oxygen obtained in this way to the production of carbide of calcium, and the result has been very satisfactory; the cost of production of the latter material would, therefore, be very much less than when produced by the electric furnace as at present. Although this will supersede the electric process, he thinks there are many other fields left for the application of electricity to heating.

ZEITSCHIFT FUER ELEKTROCHEMIE, June 20.—An announcement that, beginning with July 1, this journal, which formerly was published semi-monthly, is to appear weekly.

UNION OF GERMAN ELECTRICAL ENGINEERS.—"Zeit. fuer. Elek.," June 19.—A running account of the recent meeting, and a brief abstract of the papers.

AMBROIN. Boehlendorff. "Elek. Zeit.," June 30.—A short paper describing this material. It appears to be similar to the descriptions previously noticed.

STANDARD DIAGRAMS. Jamieson. "Elec. Eng.," July 14.—A reprint with the illustration of the article noticed in the "Digest" last week.

SUBMARINE MINES."Sc. Am. Sup.," July 9.—In this, a large, well-illustrated special edition on "The Army and Coast Defense," an illustrated description is given of the methods of laying, connecting and exploding electrically connected submarine mines.

Square Post Knife Switch.

The accompanying illustration represents a square post-knife switch, for which the Technic Electrical Works, Philadelphia, Pa., was granted design patents on June 21 last. The company has spent considerable money in introducing this switch, which it is stated has proven by use to be the most satisfactory low-priced knife switch on the market. There was considerable competition for the patents, and several concerns have already started to manufacture the goods. The Technic Electrical Works, however, being successful in securing the patents, states that it will prosecute all infringers. This switch is covered by two design patents, Nos. 28,890 and 28,891, issued to J. J. Zimmerlee, of the Technic Electrical Works.

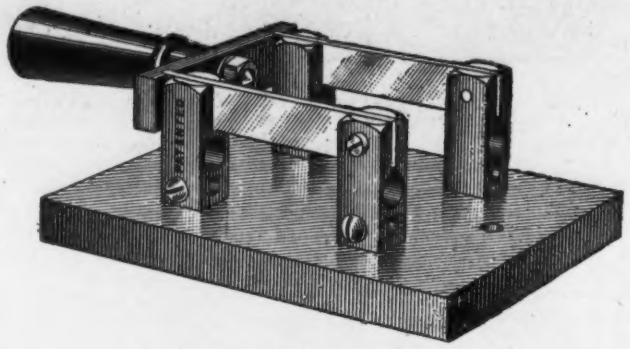
The Technic Electrical Works places a certificate on each switch, guaranteeing its electrical efficiency and mechanical construction, and will replace at any time any defective part free of charge.

Potential Regulator for Series Incandescent Lighting.

One of the great obstacles with which the series system of incandescent lighting has had to contend has been its want of flexibility. If the circuit is laid out for the full number of lamps which the normal voltage will operate, a means must be provided for increasing the voltage to take care of additional lamps ordinarily called for for a short time. On the other hand, if only a part of the possible number of lamps are connected in circuit, expensive or complicated arrangements are necessary to absorb the surplus voltage.

To regulate the voltage the following methods are in use: Extra lamps are installed at the station and cut in or out of circuit as required. This method is expensive, as the power consumed in the lamps is totally lost, and the lamps are worn out while their light is wasted.

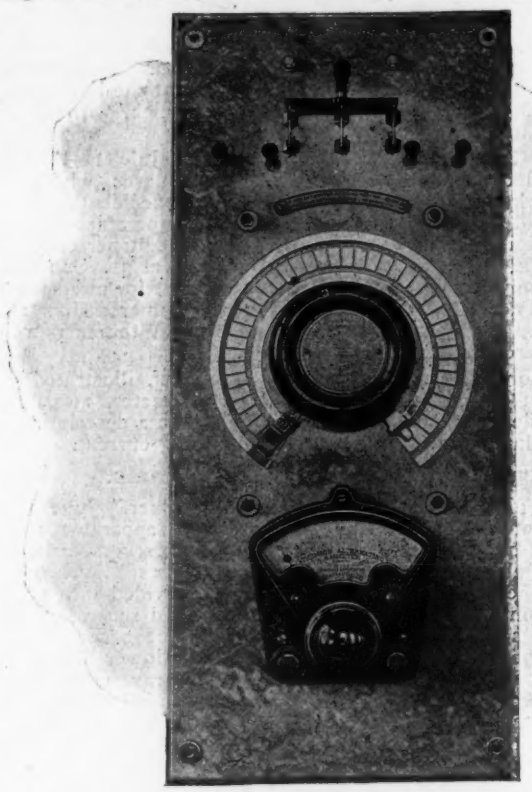
Reactive coils are placed in series with the circuit at the station. This method is also expensive, because the E. M. F. of the coil is out of phase with the voltage of the circuit and, consequently, the voltage produced within the coil will be much more than the actual reduction in the voltage of the circuit.



Square Post Switch.

Reactance or shunt coils are used in connection with each lamp in the circuit. Such coils can only produce approximate compensation for the lamps that may be extinguished and are not satisfactory for compensation for the lamps permanently out of circuit for the same reason that reactive coils are not satisfactory.

For satisfactorily controlling the voltage the General Electric Company has developed a form of potential regulator especially adapted for this work, by the use of which the series system becomes almost as flexible as a parallel system, and the power consumed in the circuit varies directly in proportion to the number of lamps in use. A regulator panel with ammeter, switch and fuses is shown in the illustration. The regulator is mounted on the back of the panel, and consists of a compensator, from the secondary winding of which, taps are connected to a set of contact blocks arranged in circular form on the front of the board. A hand wheel in the centre of the ring of contacts operated two arms carrying brushes which connect from the contact blocks to continuous rings on the inside and outside of the contact blocks. One of these arms is



Regulator Panel.

connected directly to the hand wheel, the other is connected through a bevel gear, so that the direction of rotation of one arm corresponds to that of the hand wheel, while the other moves in the opposite direction.

The compensator is so connected that whatever difference of voltage exists between the two concrete rings on the dial switch is added to or subtracted from the initial voltage of the circuit. If one arm be directly over the other, there is no difference of potential between these rings. If the hand wheel be turned to the left a gradually increasing voltage which will be added to that of the line, will be developed between the rings, while a gradually increasing voltage which will be subtracted from the initial voltage will be developed if the hand wheel be turned to the right. The ammeter below the hand wheel indicated the current in the circuit. When the number of lamps in circuit is changed it is simply necessary to turn the hand wheel until the proper current is indicated.

The compensators are wound for the standard currents of 3, 5 and 5.5 amperes, and in either case will increase or decrease the initial voltage of 1150 or 2300 by 230 volts. Special regulators giving a greater range of voltage will be built, if desired.

NEWS OF THE WEEK

Financial Intelligence.

THE GROSS EARNINGS for June of the Edison Electric Illuminating Company of New York were $215,155.92, an increase of $42,125.20 over the gross earnings last year. The net earnings were $79,435.44, an increase of $16,230.18.

THE NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY, of New York City, has filed with the Secretary of State at Albany a certificate of an increase in its capital stock from $12,000,000 to $15,000,000. The debts and liabilities of the company amount to $3,505,404. The object of this increase was outlined in THE ELECTRICAL WORLD of July 9.

THE METROPOLITAN STREET RAILWAY COMPANY, New York City, reports for the quarter ended June 30, 1898, gross earnings, $3,230,763; operating expenses, $1,628,659; net earnings, $1,602,104; fixed charges, $1,101,240; surplus, $500,924; dividends, $375,000; balance, $125,824. It was announced officially on July 15 that a meeting of the stockholders of the Metropolitan Street Railway Company would be held on August 9 to authorize the issue of $15,000,000 in new stock, not $10,000,000, as was reported recently. Of the new stock it is stated that $10,000,000 is to be sold at once to the stockholders at par; the other $5,000,000 will remain in the treasury. The new issue will increase the capitalization of the company of $30,000,000 to $45,000,000.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
9 Murray St., NEW YORK, July 18, 1898.

INSPECTOR OF ELECTRICAL CONDUITS.—Frank J. Curran has been appointed inspector of electrical conduits in the Borough of Brooklyn, at a salary of $1,200 per year.

NO SEAT, NO FARE.—Councilman Christman introduced a resolution in the Municipal Council on July 12, providing that all corporations operating elevated or surface railroads or stage lines within the limits of the city of New York shall be required to furnish seats for all passengers, and that when each vehicle is filled with seated passengers a sign to that effect shall be conspicuously displayed on the outside of the car. The ordinance also provides that when a passenger boards a car without being notified that it is filled, and is compelled to stand up, he need not pay fare until a seat is furnished to him.

THE MURDER OF MR. GEORGE R. BLODGETT RECALLED.—On the night of July 11 the New York police caught and arrested William Mason, alias "Big Bill," who is charged with murder and robbery in Philadelphia and other places. Among the crimes with which this noted criminal is charged is the murder of Mr. George R. Blodgett, at Schenectady, N. Y., on December 3, 1897. Mr. Blodgett was counsel for the General Electric Company, and was shot at his home in a mysterious manner. The murderer escaped, taking with him twenty-seven pieces of silver plate. The General Electric Company offered a reward of $5000 for his capture. An effort to dispose of this plate gave the police a clue, which led to the shadowing of Mason and his final arrest.

THE TELEGRAM WAR-TAX.—A decision as to who shall pay for the stamp that is required to be placed on every telegram has just been rendered by Commissioner Scott, of the Internal Revenue Bureau, at Washington. He decides that it is the duty of the person who makes, signs or issues the message to affix the stamp on the same. Section 7 of the act provides that if any person or persons shall make, sign or issue any instrument, document or paper of any description whatsoever without the same being duly stamped for denoting the tax thereon, the said person or persons shall be deemed guilty of a misdemeanor, and on conviction thereof shall pay a fine of not more than $100. Telegraphic dispatches and messages are enumerated in the act as requiring the documentary one-cent stamp.

MORE UNDERGROUND CONDUIT ROADS.—The Metropolitan Street Railway Company announces that on July 20 it will begin the work of installing the underground conduit system on Sixth and Eighth Avenues, south of Fifty-ninth Street. It is expected that the work will be finished and cars running over these lines by September 15. While the work is in progress the horse-car service on these two avenues will be discontinued. Meanwhile upper West-side patrons via Eighth, Columbus and Amsterdam Avenues will be carried over the electric line through Fifty-ninth Street to and from transfer points at Seventh Avenue, Madison Avenue, Lexington Avenue and Second Avenue. The Metropolitan Company will furnish extra facilities on the Seventh and Ninth Avenue horse-car lines for the accommodation of the public until the improvements on Sixth and Eighth Avenues are completed and the new lines are in operation.

SOUTHERN NOTES.

WASHINGTON, D. C., July 15, 1898.

THE JAMAICAN TARIFF.—According to advices received by the Bureau of American Republics the new tariff of Jamaica places all apparatus and appliances of all kinds for generating, storing, conducting and converting into power for light and measuring of electricity on the free list.

ELECTRIC RAILWAY CONCESSION IN BUENOS AYRES.—Mr. James G. Kelley has, according to information received by the Bureau of American Republics, applied to the municipality of Buenos Ayres for a concession to construct two underground electric railways in that city. The roads are to be ready for use within three years after the granting of the concession. Fifteen centavos will be the maximum fare, and five centavos will be charged for parcels, and 6 per cent. of the total receipts is to accrue to the municipalities. Both lines, with the entire plant and all the rolling stock, shall become the absolute property of the municipality free of any claim or compensation at the expiration of ninety-nine years.

BUFFALO AND NIAGARA FALLS NOTES.

BUFFALO, N. Y., July 16, 1898.

THE WALKER COMPANY is putting in a 150-kw generator to furnish the motive power for the new trolley line to be run from Lima to Honeoye Falls over the tracks of an existing steam line. The car to be used is equipped with four 50-hp motors, and is designed to haul freight.

THE STATE RAILROAD COMMISSION has made a preliminary inspection of the Buffalo Valley line, from Buffalo to Java, and will give a hearing soon. One hearing was appointed, but has been postponed. This road has ample means behind it and may yet be graded this year. It is of special interest to the trolley public on account of the design to make a freight as well as passenger road of it.

SO EMINENTLY SUCCESSFUL have the new electric grain elevators proven, especially the Electric elevator, that it is asserted by an engineering expert that if the projected Sturges elevator should be built it and the two now running would practically drive all the wooden elevators in Buffalo harbor out of business. The electric elevators have demonstrated that grain can be handled so much easier and cheaper than was possible with the wooden ones driven by steam power that a practical revolution has already been wrought.

THE 1,000-HP single-phase generator building by the Walker Company for the electric light company at Niagara Falls is about to be placed in the power house of the Schoellkopf Hydraulic Canal Company in the bottom of the gorge at Niagara. It differs from most apparatus of that capacity by having a frequency of 125 cycles to correspond with other machinery already in operation in the building. Otherwise the frequency would be cut down to about 65 cycles. The pressure is 2000 volts, and the current goes direct on the wires of the lighting company. Most of it will be used in the hotels on incandescent circuits.

ST. LOUIS NOTES.

ST. LOUIS, Mo., July 15, 1898.

NEW STREET RAILWAY.—The city council made a report this week recommending the passage of a bill authorizing the South Broadway Improvement Association to build and operate a street railroad. The franchise will be for twenty-five years.

AUTOMATIC TELEPHONES.—The Bell Telephone Company now has agents soliciting orders for automatic telephones. These will be equipped with a coin-receiving slot device and will be placed chiefly in drug stores. The subscriber, by term of the contract, is to receive 10 per cent. of the money taken in by the machine. The new 'phones are expected to be put up not later than August 15.

GOVERNMENT ORDERS.—The work of the Kinloch Telephone Company has been very much delayed owing to the fact that all the insulated wire available is being supplied to the Government on rush orders. The Kinloch Company ordered its wire from the Kellogg Switchboard & Supply Company, of Chicago, which placed the $250,000 switchboard in the Century Building, and was to have been supplied by July 2. It is stated that no strenuous effort will be made to force the company to live up to its contract until the War Department has been fully supplied.

THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY has moved its division headquarters from Cincinnati to St. Louis and will occupy rooms in the Telephone Building, Tenth and Olive Streets. Division Superintendent Gouverneur Calhoun has charge of the office and is also supervising an unusually large amount of new work undertaken by the company. The latter includes the construction of a test station at Madison, Ill., and the stringing of wires on new lines which are rapidly progressing toward Memphis and Kansas City. The removal of the division headquarters to St. Louis indicates that this city is to become a telephone centre. The new test station at Madison, Ill., will take the place of the present Ferry Street test station, and messages passing through St. Louis will hereafter pass through the station instead of being transmitted by the underground route. The Bell Telephone lines will hereafter converge in the Telephone Building.

PACIFIC COAST NOTES.

SAN FRANCISCO, Cal., July 10, 1898.

MR. W. F. C. HASSON is in Victoria, B. C., superintending the completion of the work of installing the British Columbia Electric Railway Company's 12-mile transmission system, which will furnish power for the street railways of that city.

RECENTLY INCORPORATED.—The Electro-Magnetic Weighing-Scale Company, of Sacramento, Cal.; capital stock, $1,000,000; objects, to manufacture

electro-magnetic weighing scales, etc. The directors named are H. G. Smith, W. P. Owens, F. B. Smith, F. F. Smith and Edward Hanak.

THERE WILL BE A CHANGE in the San Francisco agency of the Fort Wayne Electric Corporation, Mr. Charles R. Lloyd having resigned as local representative. Mr. F. N. Delanoy, who has been bookkeeper under the present management for three years past, has been given the agency. Mr. Lloyd will soon leave for England to remain a year.

THE SAN FRANCISCO GABRIEL ELECTRIC COMPANY'S water-power electric station, installed by Los Angeles capitalists, is now in successful operation. Work has been prosecuted night and day on portions of this transmission line, known as the Kerchkoff system, in order to reach Los Angeles ahead of a competing company. Three Westinghouse two-phase generators are driven by direct-connected Tuthill water wheels, manufactured in Oakland, Cal. Messrs. Hasson & Hunt were consulting engineers for the electric company.

THE BOARD OF SUPERVISORS of San Francisco recently decided to follow the Merchants Association's plan in advertising for bids for street lighting beginning August 1 next. There will be arc lights on Market Street, from the ferries to Valencia Street, on Golden Gate Avenue, from Market to Devisadero, and on Folsom Street, from Third to Twenty-sixth Street. The lamps on the business streets and driveways are to be lighted every night in the year, although it is claimed that a three-night moonlight schedule would reduce the expense $30,000 a year. The prevalence of fog makes a moonlight schedule undesirable.

THE MARKET STREET RAILWAY COMPANY, San Francisco, has just successfully inaugurated its through electric service from the ferries to the ocean beach. A blue car leaves the Ferry Depot every half hour, running out Mission Street and zigzagging across town to pick up transfers from a number of lines. After traversing Oak, Stanyan and Fredericks Streets, the line follows H Street and the new roadbed on the right of way formerly used by the old Park & Ocean steam line to the Pacific Ocean near the Cliff House. A ten-minute service is given over a short line from the ferries to Ninth Avenue and H Streets. Also, a service from the Potrero, connecting at Eighteenth and Kentucky Streets with the new Market Street and Ocean Electric line. H. H. Lynch had charge of construction.

Canadian Notes.

Ottawa, Ont., July 16, 1898.

THE QUEBEC ELECTRIC RAILWAY has definitely passed into the hands of the Quebec, Montmorency & Charlevoix Railroad Company. Colonel Strathy, of Montreal, the representative of the new syndicate, paid the company which built the Quebec Electric Tramway, $1,500,000.

THE CITY COUNCIL of Hamilton, Ont., has decided, in respect to the street railway of that city, to submit the following questions to the ratepayers on July 27: (1) Shall the city purchase and operate the Hamilton Street Railway (2) If the city does not now purchase the Hamilton Street Railway should the council extend the franchise of the company for fifteen years?

THE REV. FATHER PARADIS, of colonization fame in Northern Ontario, is in Montreal, and his energies are being directed, just now, to secure an electric tramway from Dunreney, 2 miles from Verner, to the waters of Lake Trinagain, a distance of 26 miles. This lake is surrounded by fertile land and its connection with the C. P. R. is greatly to be desired. Father Paradis states that the water power is all that can be desired, and he hopes that with a little aid from the Ontario Government, the road can be completed in the near future.

MR. C. O. PALMER, manager of the Sun Life Insurance Company at Kingston, Jamaica, is at present in Canada in this vicinity. He speaks highly of the project of harnessing the Rio Cobre by the West Indian Electric Company, which is one of the largest schemes ever ventured in Jamaica. The works, which have already made considerable progress, are situated near the great tunnel at Boy Walk, at which point the river is 160 feet wide. The dam will stretch from one bank to the other, to be imbedded in the solid rock. In order to provide against all contingencies the dam will be three times as strong as its estimated pressure. The foundations of the dam have already been built. The concrete and masonry sunk in the rock of the river bottom will go 10 feet below the water, and above the water the walls of the dam will rise some 9 feet. The water is taken in from the dam by a pipe 8 feet in diameter. The pipe will convey about 20,000 cubic feet of water, or about 120,000 gallons a minute to the power works. It is provided with a steel valve to regulate and control the supply of water, and runs alongside the river for a mile and a quarter from the dam to the power house. The power house will be built entirely of steel and concrete, the steel work alone weighing 250,000 pounds. The river in its course for a mile and a quarter drops about 47 feet, which, added to the foot of the dam, amounts to 56 feet, which will be the fall of the pipe in its course to the works.

Montreal Que., July 15, 1898.

A BY-LAW authorizing the construction of an electric railway between St. Catharines and Port Dalhousie has received its first reading in the St. Catharines, Ont., Council.

THE RATEPAYERS of Waterloo, Ont., have sanctioned the by-laws granting a bonus of $12,000 to the Galt & Preston Electric Railway Company for the extension of its lines.

THE PROMOTERS of the Hamilton, Chedoke and Ancaster Railway state that the road will be constructed to Hamilton provided the Council buys the Beckett Mountain Drive.

THE TORONTO STREET RAILWAY COMPANY has had plans prepared for several proposed extensions, including the second line down Station Street. This line will be built as soon as the bridge over the Yonge Street track is built by the city. This bridge will cost, it is estimated, $200,000.

English Notes.

(From Our Own Correspondent.)

London, July 6, 1898.

RECENT LITIGATION.—Several matters of electrical interest have appeared in the law courts recently. Only last week Mr. Justice Kekewich practically overthrew the micanite patent in an action brought by the owners of that patent for alleged infringement. In his judgment Mr. Justice Kekewich stated that a prior user of substances practically the same as micanite had clearly been proved. In the prosecution it was attempted to be shown that micanite differed essentially from previous compounds of mica, in that with micanite the mica has not to be cut into regular pices, but the elementary feather-edged scales are used without any other material to which to fasten them. In all previous attempts to build up a micaceous material the mica had been cut into regular pieces and shellacked piece by piece. Another important action is now going on and relates to the use of horizontal reflectors for alternate current arc lamps. This action, brought by the Helios Company, of Cologne, purports to claim for this company the patent right to place a horizontal mirror over the upper carbon of this kind of arc. The action is not yet decided.

FIRE AT A LONDON ELECTRIC LIGHT STATION.—Last week a disastrous fire broke at the back of the switchboard of the South Street, Manchester Square, station of the Metropolitan Electric Supply Company. The fire was caused by a piece of extreme carelessness on the part of the switchboard attendant, who inadvertently switched two machines in parallel. The supply from the Manchester Square station is on the old alternate system, in which the circuits are run independently and the alternators are never in any case paralleled, so that an arc was formed as soon as the man put in the wrong plug. This arc set fire to the india-rubber cables at the back of the switchboard and the flames very soon reached the roof, which was completely destroyed. By a piece of luck, the machines themselves, which are turbo-generators, were not damaged by the fire, but the water played considerable havoc among them. The fire occurred about midnight, but early the next morning it was possible to connect most of the mains to the trunk lines leading from the other stations of the Metropolitan Electric Supply Company, and later on the Grosvenor Gallery sub-station of the London Electric Supply Corporation also assisted, so that before dusk all lights were again burning. Two of the generating sets at the Manchester Square station have already been got into working order again, and the staff is hard at work putting things right. As at the present time the demand for new connections exceeds 1000 8-cp lamps per week, it is of the utmost importance that this station should be able to supply its full share of the load as soon as possible. The loss is fully covered by insurance.

THE BROMPTON AND PICCADILLY CIRCUS RAILWAY.—The latest addition to an important and gradually increasing class of suburban railway in London, viz., the Greathead tunnel underground railway, is the line which it is proposed to construct between South Kensington and Piccadilly Circus. The route is about 2 miles long, and will consist of double tracks in separate tunnels. There are to be seven stations in all, including the terminals, and the single journey will be performed in about ten minutes. The power house for this line is to be built on the Thames at Chelsea, and will be connected to the railway system by steel armored cables buried in the ground. The authorized share capital of this concern is $3,000,000, with borrowing powers of $1,000,000. The prospectus of this undertaking anticipates that a train mileage of 412,256 per annum will be run, and that the gross revenue will attain nearly 90 cents per train mile, the total expenditure not being more than 36 cents per train mile. It will thus be seen that it is expected to run the railway on the basis of 36 per cent. ratio between the total costs and the gross revenue. It is claimed that after paying an interest of 3½ per cent. on the borrowed capital there will be a margin sufficient for a 6 per cent. dividend on the share capital. This line, if constructed, will tap a very important part of the West End and Central London, as it will connect the existing underground railway at South Kensington with the new Waterloo and Baker Street electric underground railway at Piccadilly Circus. It thus connects, on either side, an extensive system of railways and suburban lines with a district that has hitherto only been served by horse omnibuses.

French Notes.

(From Our Own Correspondent.)

Paris, June 30 1898.

ELECTRIC TRACTION, a new surface contact system. M. Louis Bertrand has invented a surface contact system which possesses some advantages. The principle of the system lies in the use of the car-wheel flange as it travels in the groove of the rails. The wheels bear at intervals on cams in the tram rail groove, and in this way set in motion current distributors. The advantage of this system is that there are no projections above the level of the roadway. But the question is, will it work continuously without getting out of order? Practical experiment only can settle this point.

IMPROVEMENT IN TELEPHONES, or more, correctly speaking, an improvement in the telephone service. Everyone knows how unpleasant it is to be interrupted in the middle of a conversation by the telephone girl breaking in and inquiring if you have done yet? Some of the exchanges have been furnished with a device to show the operator that the line is still in use without the necessity of breaking in on the conversation to find out. A small lamp is set up just above each number, and it lights up when the instrument begins to be used, and is extinguished when the receiver is returned to the hook.

A NEW ELECTRICAL TRAMCAR.—The Fives-Lille Company is building an electrical tramcar which has some rather interesting features. The motors for propelling it embody some very noticeable improvements over those that have hitherto been used. Repairs are very easily made and do not require especially trained labor, all parts being on the interchangeable system. The motor is series wound, and its weight complete with gears and all accessories does not exceed 1900 pounds. This is comparatively light weight, considering the power of the motor, which is normally 10 horse-power, but can be doubled or tripled for a short space of time. The speed, 500 r. p. m., is low enough to require only single reductions. The armature is ring wound, and the field is of a closed frame of cast steel made in a single piece, and is therefore mechanically very strong. The car carries two motors, so that if one should need repair the car need not be put out of service. These motors are supported on brackets, and they drive the axle through a gear. The effi-

ciency of transmission, including the gear, is 80 per cent. The universal controller which will be supplied to the car provides all the necessary control by simply turning a handle, such as starting, stopping, speed regulation, reversing and the application of the electric brake. The car body which will be used is a design appropriate to hot countries, or for use on lines running to bathing resorts, or for use in large cities and their suburbs during the summer season. It weighs, all complete, including machinery, about 10,500 pounds. The car framework, which is entirely of metal, is mounted on steel axles, forced into iron wheels, provided with steel tires. The wheel base is such as to allow the car to take a curve of 50-foot radius on a track not provided with guard rail or having a very wide groove. There is a question which for Continental European governments has another side, and one which is of great moment, too. That is the mobilization and transport of troops; the best planned movements may fail as the result of some accident which stops traffic at the critical moment. It is therefore of the greatest importance to military trains to attain the highest speed possible and a perfectly reliable service. The Fives-Lille Company, which manufactures in its shops at Givors all the brake apparatus used on the locomotives and carriages on the State railways and on the Orleans and Southern roads, has been led to make a study of the question of brake action. After lengthy and painstaking research and numberless experiments the company has evolved a mechanical equipment which makes it possible to stop without danger and with all desirable speed the longest trains used on the French lines.

General News.

NEW INCORPORATIONS.

THE EXETER TELEPHONE COMPANY, Manchester, N. H., has been formed with a capital stock of $3000.

THE MISSOURI & IOWA TELEPHONE COMPANY, Des Moines, Ia., has been incorporated with a capital stock of $25,000.

THE ALBION POWER COMPANY, Albion, N. Y., has been incorporated with a capital stock of $50,000. The directors are Frank A. Dudley, Wallace C. Johnson, Sanford T. Church and Albert Culver.

THE GROSS ELECTRIC EXPERIMENTAL COMPANY, Gillespie, Ill., has been incorporated with a capital stock of $12,500. The incorporators are: William M. Gross, John H. Eilers and William W. Williams.

THE CROWDUS COMPANY, Chicago, Ill., has been incorporated for the purpose of manufacturing electrical devices. Among those interested are Thomas B. McGragor, Frank G. Howser and Belle W. Barry.

THE ALVIN & ANGLETON TELEPHONE COMPANY, Alvin, Tex., has been formed with a capital of $2000. The incorporators are O. S. Cummings, A. J. Birchfield, F. J. Bush, A. W. Wilkinson and W. A. Leonard, all of Brazoria County.

THE OKLAHOMA TELEPHONE COMPANY, Guthrie, Okla., has been formed with a capital stock of $100,000. The incorporators are: Harry C. Barter and George R. Gorden, of Brownington, Mo.; William E. Moore and McGregor Douglass, of Oklahoma City.

THE MANHATTAN INSTITUTE OF ELECTRO-THERAPEUTICS, of New York City, N. Y., has been incorporated with a capital stock of $25,000. The directors are: Henry H. Goldberg and Ralph H. Goldberg, of New York City; and T. M. Buckley, of Brooklyn.

THE OSHKOSH, OMRO & BERLIN ELECTRIC RAILWAY CONSTRUCTION COMPANY, Oshkosh, Wis., has been incorporated with a capital stock of $25,000. The incorporators are: S. W. Hollister, J. W. Himebaugh, Clement C. Smith, J. H. Jenkins and A. B. Ideson.

THE COON RAPIDS ELECTRIC LIGHT & POWER COMPANY, Coon Rapids, Ia., has been formed with a capital stock of $5100. The officers of the new company are: President, A. N. Wilson; secretary and treasurer, O. D. Houghton; trustees, O. M. Taylor, L. B. Houghton and L. J. Wilson.

THE EPHRATA ELECTRIC COMPANY has been organized for the purpose of furnishing light, heat and power to the Borough of Ephrata, Pa. The capital stock of the company is $15,000, and the directors are: F. E. Bailey, Philadelphia; A. W. Mentzer, Ephrata; H. G. Mentzer, Ephrata; S. N. Bailey, Dillsburg; John W. Von Neida, Ephrata.

THE BEACON LIGHT COMPANY of Darby, the Beacon Light Company of Ridley Park, and the Beacon Light Company of Glenolder, Pa., have been incorporated. Each has a capital of $1000, and the directors are: George C. Hetzel, Ridley Park; J. E. Cochran, Jr., George S. Howell, and Thomas S. Hall, Chester, and E. H. Davis, Brooklyn.

THE CENTRAL ELECTRIC RAILWAY COMPANY, of Kansas City, Mo., has been incorporated with a capital stock of $1,000,000. Mr. James M. Davis, of New York City, is the principal stockholder. The new concern will merge with the Northeast Railway Company, and branch out into one of the leading city railroad properties in Kansas City.

THE LIMA-HONEOYE ELECTRIC LIGHT COMPANY, Buffalo, N. Y., has been formed with a capital stock of $125,000. The directors are: Hardin H. Little, Robert L. Fryer, John C. Conway, Peter P. Miller, Henry W. Box, Albert L. Williams and Clarence McGregor, of Buffalo; Alex. M. Holden, of Honeoye Falls, and Horace C. Gilbert, of Lima.

THE TELEGRAPH AND TELEPHONE.

ORRVILLE, OHIO.—The Millersburg Telephone Company is putting in an exchange in this place.

WAYCROSS, GA.—The long-distance telephone line has been extended to Douglas from Nichols, on the Waycross Air Line.

SPRINGFIELD, TENN.—The Cumberland Telephone & Telegraph Company is building a new line from Springfield to Baggettsville.

JACKSONVILLE, TEX.—The Southwestern Telephone Company's line has reached this point, and is connected with the East Texas Telephone Company's system.

DETROIT, MICH.—The Detroit Switchboard & Telephone Construction Company has filed a notice that its capital stock has been increased from $100,000 to $250,000.

SAN FRANCISCO, CAL.—The Executive Council of Hawaii has signed a contract with the Scrymser Company to lay a cable from San Diego, Cal., to Honolulu and Japan.

WAYNESBURG, PA.—The Central District Printing & Telegraph Company has reduced its rates of rental to $15 per year for business houses and $12 for direct residence lines.

GOSHEN, IND.—The Central Union Telephone Company is reconstructing its system in this place. The poles will be replaced, the office equipped with two switchboards and everything else done to make the system a perfect one.

COLUMBUS, WIS.—The new exchange in this place of the Wisconsin Telephone Company has been completed. The metallic circuit between Columbus and Watertown is finished, and work will be commenced on the line to Portage and Baraboo.

TIFFIN, OHIO.—The Ohio Telephone Toll Line Company is building a line from Tiffin to Millersville. The Ohio Company's line begins at the city limits, and will connect with the Home Telephone Company's system, which operates in this city.

SIOUX CITY, IA.—The Northwestern Telephone Exchange Company has commenced the construction of a line from Spring Valley to Lacrosse. A long-distance service will thus be furnished to numerous towns along the Southern Minnesota Railway.

CLEVELAND, OHIO.—The Home Telephone Company, of this city, has been reorganized, Mr. Henry A. Everett being elected president and general manager; Mr. E. W. Moore, vice-president; Frank H. Price, secretary; John Sherwin, treasurer. The company is capitalized at $500,000.

SPRING VALLEY, MINN.—The Northwestern Telephone Exchange Company has begun the construction of a line from here to Lacrosse. This will give a long distance service to Wykopf, Preston, Lanesboro, Rushford and several smaller towns along the Southern Minnesota Railway.

NARRAGANSETT PIER, R. I.—A new Government cable was laid on July 11 between Block Island and Narragansett Pier. At Narragansett it connects with the Providence Telephone Company's line, thus giving direct long-distance communication from Block Island to New York and Washington.

WYNNEWOOD, I. T.—A telephone company has been organized in this place to build lines to various places in this section of the country. It is stated that all the money necessary to carry out the enterprise has been subscribed by the citizens, and the work will be commenced at once.

CHESTER, ILL.—The entire plant of the Chester Mutual Telephone Exchange has been transferred to Mr. A. G. Gordon. The system will be at once reconstructed, and the automatic switchboard will be replaced with a manual switchboard. New and improved instruments will also be put in.

CLEVELAND, OHIO.—Several months ago the telephone company decided to make pay stations of all telephones in drug stores. The druggists took the matter up and refused to enter into the contract. A meeting of the representatives of both sides was held a few days ago, and resulted in the druggists agreeing to the proposed arrangement.

GREENVILLE, S. C.—The Piedmont Telephone & Telegraph Company has been organized by George A. Browning, president of the Greenville Home Telephone Company. The new company will establish exchanges at Anderson, Abbeville, Greenwood, Laurens and other places. The exchanges will be connected by metallic circuit and long-distance instruments.

DETROIT, MICH.—The Fire Commissioners have taken final action relative to the proposed independent telephone system for the use of the department. The contract for telephone apparatus was awarded to the Holtzer-Cabot Electric Company, of Brookline, Mass., for $930, and for the cable to the Standard Underground Cable Company, of Pittsburg, Pa., for $3,081.23.

DES MOINES, IA.—The City Council recently ordered the Iowa Telephone Company to vacate the streets of the city, claiming that the company had no charter allowing it to operate there. The telephone company claims that it has the right to operate a telephone line in the city and string its wires on any street it desires to traverse, and that it would not comply with the order of the Council. It is likely that the case will be taken into court.

DES MOINES, IA.—It is stated that there is a movement on foot for the consolidation of all the independent toll lines in the State under one management, and the merging of the several companies into one organization. Propositions for the proposed consolidation have been forwarded to the management of the different lines, and it is stated that there is every indication that they will be accepted. A meeting to outline the general plan of consolidation will be called at an early date. The nucleus will probably be the Central Telephone Company, of this city.

WABASH, IND.—James Brairly, of Wauseon, Ohio, has formed a company and purchased the franchise of an abandoned telegraph line between Fort Wayne and Chicago, and will use it for an independent telephone line. By this means the network of northern Indiana independent telephone toll lines will be connected with Chicago, and ultimately with Indianapolis, when the New Telephone Company, of the latter city, gets its exchange into operation. It is stated that connection with many independent exchanges in Western Ohio and Southern Michigan will also be obtained.

PHILADELPHIA, PA.—The Common Council on July 11 passed an ordinance granting to the Drawbaugh Telephone & Telegraph Company the privilege of constructing and operating a system of electric wires and cables through or under the streets of this city, for the purpose of conducting a telephone business between various exchanges, subscribers and patrons. Col. Joseph S. Stokes is president of the Drawbaugh Company in Philadelphia, and Mr. J. R. Bartlett, of New York, is president of the parent company. The ordinance now awaits the signature of the Mayor. It authorizes and empowers the company to

hire, rent, lease or purchase any underground conduit or system of cables and wires that may have been or may hereafter be constructed by the city or by any corporation, firm or individual under existing ordinances. The company is required to furnish for the use of the city, and without cost, two ducts or chambers in its conduits, and free telephone service is to be afforded to the various city departments. The company is required to fix the maximum cost of its annual service per instrument for business houses at $75, and for private dwellings at $50.

Electric Light and Power.

CHICAGO, ILL.—The Hyde Park Electric Light and Power Company has confessed judgment for $23,102.

CRESCO, IOWA.—Mr. B. S. Wilder is seeking a twenty-year franchise to establish an electric light plant in this place.

FORT WORTH, TEX.—Mr. Emmett A. Ellis has purchased a controlling interest in the Standard Light & Power Company, of this city, paying therefor $60,000.

UPPER SANDUSKY, OHIO.—The Citizens Electric Light Company of this place has completed arrangements to establish an incandescent light plant to be ready for operation by September 1.

FOSTORIA, OHIO.—The Fostoria Light & Power Company will probably be purchased by a Philadelphia company. The stockholders of the Fostoria Company will pass upon the matter.

BELOIT, WIS.—The Beloit Electric Light & Power Company has purchased the old Rock River paper-mill property, and will use it as an electric light and power plant. The purchase carries with it a valuable water power. The electric company will spend $25,000 in improvements.

CINCINNATI, OHIO.—The works of the Cincinnati Edison Electric Company, on Eighth Street, near Plum, were burned on July 9, entailing a loss of $40,000. It is stated that there was no insurance on the property. The fire was started by the explosion of a boiler. It is reported that the arc machines were not injured.

LYNCHBURG, VA.—On July 26 capitalists from New York and other places, who recently purchased the property of the Lynchburg Electric Company, including the street railway, will meet for the purpose of organizing and electing officers of the new company, which will be known as the Lynchburg Electric & Light Company.

BALTIMORE, MD.—The Northern Electric Company, of this city, has been awarded the contract to light the cathedral by electricity. The system of lighting will be elaborate and was planned by the Rev. C. T. Thomas, the rector, who has been studying the problem for two years. From 600 to 700 16-cp lamps will be placed in the building, which is now being wired.

CANAL DOVER, OHIO.—The firm of Leiser & Bowers has decided to build a large electric light and power plant for their new flour mill. The plant will be erected on the site of the old mill, which was destroyed by fire several months ago, and the water power from the Tuscarawas River will be utilized to generate electricity. It is proposed to distribute electric current to all parts of the county if a sufficient number of subscribers can be secured for light and power.

The Electric Railway.

WATERBURY, CONN.—At the annual meeting of the Waterbury Traction Company, which was held on July 11, Mr. A. M. Young, was elected secretary and a director. Mr. Young is president of the National Electric Light Association.

CLEVELAND, OHIO.—Fire on July 11 destroyed the car house of the Cleveland Electric Company, situated at Wilson Avenue, near Woodland Avenue. Eleven motor and trail cars were badly damaged. The loss of about $11,000 is covered by insurance.

CHICAGO, ILL.—The Chicago & Milwaukee Electric Railway Company on July 7 opened its line for traffic between Highland Park and New Chicago. There is but one track in readiness, but the switches at mile intervals are expected to permit of the use of several cars.

KENOSHA, WIS.—Another request has been made for a street railway ordinance by the Milwaukee, Racine and Kenosha Electric Railway Company. The question was brought up and discussed at a special meeting of the Council, and it was agreed to have a special committee appointed to draw a new ordinance.

ORANGE, N. J.—The Suburban Traction Company's property was sold on July 6 to the Orange & Passaic Valley Railroad Company for $100,000. The sale was made subject to the certificates issued by the receiver, amounting to $75,000 and incidental expenses of $25,000, and it is stated that the new purchasers will make an effort to secure an extension of the road to South Orange on the south and through to Passaic on the north. The Suburban line is a single track road 10 miles long.

HUDSON, N. Y.—It is stated that the Hudson street railway will soon be extended to Claverack and Philmont, and at the latter place will connect the county seat with the Harlem Railroad. It is reported that New York capitalists have recently bought the road, and that it is proposed to expend $200,000 in the construction of a large power plant on the Hudson River. It is stated that the new company that will develop this enterprise is to be called the Jansen Kill Power Company. It is the intention of the company to utilize the water power of the Jansen Kill.

Legal Note.

AT FORT WAYNE, IND., a decision involving the validity of bonds of the Fort Wayne Consolidated Sheet Railway Company was rendered July 13 by Judge O'Rourke, of the Circuit Court. The court declares invalid $606,000 5 per cent. bonds of the company issued by the late John J. Shipherd, of Cleveland, as president of the company, and which were intended to take up a prior issue of 6 per cent. bonds of the company. It says that bonds were fraudulently diverted from their purpose. The decision places Frank De Haas Robinson, of Cleveland, in possession of the property hypothecated by Shipherd.

Personal Notes.

PROF. E. F. NORTHRUP, formerly of the University of Texas, Austin, Tex., is now connected with the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa.

MR. HENRY G. ISSERTEL has recently taken the management of the Walker Company's New England office, his headquarters being at 53 State Street, Boston, room 313. Mr. Issertel's first experience in the electrical business was received in Boston. He was one of the corps of experts for the old Thomson-Houston Company, and in his capacity as engineer he assisted in the building and equipping of some of the principal roads in New England. The past ten years Mr. Issertel spent in New York City.

Obituary Note.

MR. JOHN MASON JACKSON, of Chicago, died in Honolulu, Hawaii, on July 6, at the age of thirty-nine years. His body will be embalmed at Honolulu and shipped to Chicago for interment. Mr. Jackson started for Yokohama, Japan, last October, partially on business for the Western Electric Company, of which he was treasurer, and partially for his health. He was there until two months ago, when he started for home. When he arrived at Honolulu he was so well pleased with the climate that he decided to stop there for a time and in his recent letters he stated that his health was rapidly improving. The news of his death was a great shock to his many friends. Mr. Jackson was in the employ of the Western Electric Company for twenty-five years.

Trade and Miscellaneous Publications.

"GRAPHITE AS A LUBRICANT."—The 1898 edition of a pamphlet entitled "Graphite as a Lubricant," issued by the Joseph Dixon Crucible Company, Jersey City, N. J., has just been issued. Its contents are made up chiefly from those of the 1897 edition, but it has some additional matter covering four extra pages. Two or three things are worth noting: First, the lubrication of the engine cylinders; second, the hand oil pump; and third, the experience of an expert engineer with flake graphite in the way of saving power and oil. An official of the Pennsylvania Railroad Company used finely puverized graphite for lubricating a gas engine, with the most remarkable results in the way of better lubrication. The use of a hand oil pump in lubricating engine cylinders is not new, but it has been found that a small hand oil pump is one of the most efficient devices for introducing oil or graphite just where it is wanted. The pamphlet is well worth the careful reading of any engineer, and a copy of the same, as well as samples of the graphite, may be obtained by any one interested by addressing the company.

AUTOMATIC CUT-OFF ENGINES.—The Ball Engine Company, Erie, Pa., has issued a very artistic catalogue of its automatic cut-off engines for electric lighting, electric railways and general manufacturing plants. The advantages possessed by these engines for these services are concisely set forth, and a general description of the construction of the engine enables one to appreciate the good points of this well-known machine. The catalogue is very handsomely illustrated. The engines described and illustrated are of these types: Single cylinder engines, horizontal tandem compound, non-condensing and condensing, horizontal cross compound, non-condensing and condensing, vertical single cylinder engines and vertical cross compound. In the tandem compound engine the general features of frame, shaft, valve and governor which distinguish this company's single cylinder engine are preserved, while the arrangement of the valve motions, one on each side of the engine, avoids the unsatisfactory results of complicated valve gear. The cross compound engine occupies less floor space for equal power than a tandem compound engine and permits of a higher rotative speed and freer access to the pistons. In vertical engines the company builds single cylinder, tandem compound and cross compound. In the design of this engine due consideration was given to ease of access for adjustment or removal of any part subject to wear. An independent valve motion for each and every cylinder is employed, thus rendering each of these a perfect engine in itself. The means of lubrication are very complete. The design of the housings is such that there is an entire absence of vibration, and owing to the manner in which the shaft is introduced into the housings it is not necessary to disconnect any column or prop up any upper works either to place the shaft in position or to roll it out of place. The valve connections are simple and direct, and the engines are economical in the use of steam, the regulation being of the best.

Trade and Industrial Notes.

THE CORNMAN COMPANY, Cleveland, Ohio, dealer in electrical supplies, has made an assignment.

THE WORKS of the Lincoln Electric Company, of Cleveland, were destroyed by fire on the night of July 15.

THE AMERICAN IMPULSE WHEEL COMPANY, 120 Liberty Street, New York, has secured the contract for furnishing water wheels for the lighting station for the city of Columbus, Ohio.

THE WORKS of the Williams & Abbott Electric Company, Cleveland, Ohio, were destroyed by fire on May 28 last. The company has located at No. 10 Columbus Street and resumed operations on July 18.

CHANGE OF NAMES.—The Colby Electrical Manufacturing Company, of Chicago, has changed its name to the Chicago Non-Refilling Bottle Stopper Company, and the Ballard Electric Company, of Chicago, has changed its title to the Wells-Goodhue Company.

THE ADRIAN WATER COMPANY, Adrian, Mich., is about to increase its electric light plant by the addition of a tandem compound engine now

being built by the Ball Engine Company, of Erie, Pa. The Ball Company has recently received orders from Mexico for several engines.

MESSRS. MACHADO & ROLLER, 203 Broadway, New York, state that Whitney instruments are meeting with favor and a correspondingly increasing demand. The dead beat attachment to these instruments is proving to be a very serviceable device. The A. E. G. incandescent lamps, for which Messrs. Machado & Roller are the United States agents, are reported to be growing in favor among central station managers and consumers in general.

THE ELECTRIC APPLIANCE COMPANY, Chicago, has just issued a very neat circular of electrical house goods specialties for which it is general Western agents. The circular gives particular attention to the Noxall annunciator, showing in detail the construction and operation of the machine. The Electric Appliance Company will be pleased to send a copy of this special circular and price list to any of the trade who has not received the same.

MR. FRANK A. ROGERS has just accepted the position of general manager of the Cleveland Electric Company, Cleveland, Ohio, manufacturer of high-grade electrical specialties. Mr. Rogers was for a long time general manager of the Card Electric Company, of Mansfield, Ohio. The office and works of the recently organized Cleveland Electric Company are at 14-16 Middle Street, Cleveland. Mr. W. J. Morgan is the president of the company, Mr. F. C. McMillin, vice-president, Mr. O. P. Fisher treasurer, and Mr. N. C. Stevens secretary.

THE OHIO ELECTRIC SPECIALTY MANUFACTURING COMPANY, Troy, Ohio, states that all articles of its manufacture have been designed by persons at present connected with the company and others who have never had any connection with the company since its organization, and that all reports to the contrary have no foundation in truth. This company is the sole manufacturer of the "Perfection" brush. It states that all so-called improvements are unnecessary and not conducive to the good qualities of the brush. The high qualities of the brush manufactured by this company have not been sacrificed to price and all orders are filled with its usual promptness.

AT THE OMAHA EXPOSITION.—Among the engine room accessories shown at the Omaha Exposition is the Cross oil filter, which is manufactured by the Burt Manufacturing Company, Akron, Ohio. This company claims to be the largest manufacturer of oil filters in the world. The Cross oil filter is reported to be giving entire satisfaction wherever it has been placed, and its use is very extensive indeed. Extracts from letters received from concerns using this make of filter show that the device pays for itself in a comparatively short time. It effects a very considerable saving of oil, and the quality of the filtered oil is excellent. It removes all foreign particles from the oil in a very satisfactory manner, and by its use oil may be purified and used over and over again on engines.

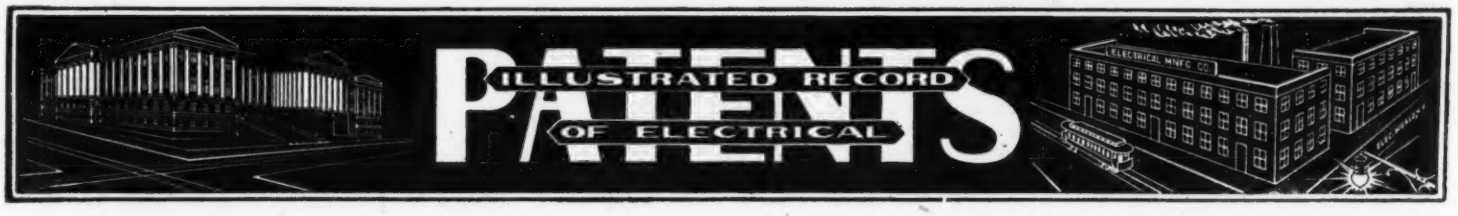
MANUFACTURERS BUILDING.—One of the largest and best-equipped power buildings in the United States is the Manufacturers Building, Providence, R. I. This building has accommodations for upward of sixty manufacturing concerns, being particularly equipped with conveniences for the production of jewelry specialties, etc. The Manufacturers Building Company has just purchased a 250-kw, 500-volt Westinghouse Electric & Manufacturing Company's engine-type generator, 100 r. p. m., to be driven by an Armington & Sims Corliss engine. This generator will supply power for the operation of motors in the various manufacturing departments of the building. The engineering features of this establishment are under the direction of Lewis & Claflin, consulting engineers, whose wide reputation for engineering installations of the highest order is well known.

THE ELECTRICAL ENGINEER INSTITUTE OF CORRESPONDENCE INSTRUCTION is distributing a very attractive little circular entitled "Can I Become an Electrical Engineer?" which is sent free upon request, and which contains numerous portraits of prominent scientists and engineers who have succeeded in making the profession of electrical engineering what it is to-day. The standard of practical instruction set by the institute is of a decidedly practical nature, and among those who have prepared papers for its courses are Professor Francis B. Crocker, of Columbia University; Charles F. Scott, of the Westinghouse Electric & Manufacturing Company; Elmer G. Willyoung, William Maver, Jr., who is an authority on telegraphy, and Thorburn Reid, designer of electrical machinery, together with many others, who are well known in other particular branches. The home offices of the institute are at 120 Liberty Street, New York.

THE RARITAN COPPER WORKS.—The development of electrolytic processes for the production of refined copper has proceeded very rapidly during the past three years, and at the present time a very large proportion of all the refined copper is thus produced. The Westinghouse Electric & Manufacturing Company has installed a very large amount of apparatus for this class of service. One of the principal installations is at the refinery of the Anaconda Copper Company, Anaconda, Mont., where ten generators of 270 to 300-kw capacity have been installed. Another very large installation is that of the Boston & Montana Consolidated Copper & Silver Mining Company, Great Falls, Mont., where two 810-kw Westinghouse engine-type generators are in service. The latest comer in this field is the Raritan Copper Works of Perth Amboy, N. J., who are about to erect the largest copper refinery in the East. They have contracted with the Westinghouse Electric & Manufacturing Company for three 600-kw, 150-volt, engine-type generators, 150 r. p. m., with a nine-section switchboard for electrolytic service and the operation of two 75-kw, 220-volt, engine-type generators, which will be used for lighting and power service. The installation will it is stated be the most complete of its kind in the world.

Business Notice.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 9-15 Murray Street, New York City.



UNITED STATES PATENTS ISSUED JULY 12, 1898.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

11,678. ELECTRIC SIGNALING MECHANISM; L. G. Rowand, of Camden, N. J. App. filed Dec. 15, 1897. In combination, a main circuit, signaling devices on said circuit, a second circuit, receiving devices on said circuit, an electric device on said main circuit, a switch device consisting of two members, controlling said second circuit, the first member of which is moved in one direction, by said electric device when energized, and means to return said member to its initial position when said electric device is de-energized, and a device adapted to hold said second switch member out of electric connection with said first switch member in its movement under the action of the electric device, and means to retard the return movement of said first switch member when said electric device is de-energized.

607,018. UNDERGROUND ELECTRIC CONDUIT; T. Connelly, of Chicago, Ill. App. filed Nov. 12, 1897. A conduit composed of a series of tubes laid coaxially, said tubes being chamfered on their ends, and an unbroken, corrugated, metallic ring over the joints, for holding the said tubes in line.

607,027. AUTOMATIC FIRE EXTINGUISHING AND ALARM APPARATUS; H. Eversmann, of Cincinnati, Ohio. App. filed Aug. 21, 1897. In a sprinkler system for fire-extinguishing purposes, the combination of a normally charged supply pipe and a normally empty sprinkler pipe, an intermediate valve-housing to which each connects and through which they communicate, a valve fitted into this valve-housing with a sliding adjustment and dividing the same into two parts in a manner to prevent communication between such parts at all times, so that when that part of the valve-housing opposite to the charged pipe is filled with a liquid at a pressure exceeding the pressure in the charged pipe, such valve is adapted to hold the valve-housing closed against the charged pipe, an outlet opening in the charged part of the valve-housing and means to open and close this opening.

607,065. TROLLEY FOR THIRD RAILS; L. M. Maxham, of Boston, Mass. App. filed Sept. 1, 1897. In combination, the plain-surfaced third rail, the trolley wheel running thereon, bearing for said wheel adapted to resistingly permit a slight canting of the same, and means whereby such canting automatically guides said wheel toward the centre line of the third rail.

607,070. ELECTRIC CABLE FOR DRIVING CONVEYANCES; A. Norman, of Toronto, Canada. App. filed April 19, 1897. An electric cable consisting of continuous positive and negative conductors, insulating material between and surrounding the said conductors, and a switch for each conductor attached to and surrounding the cable.

607,078. ELECTRODE PLATE FOR ELECTRIC ACCUMULATORS; P. Ferdinand Ribbe, of Berlin, Germany. App. filed Jan. 25, 1898. An electrode plate, comprising a lead plate, having openings, the celluloid bars on each side of said plate and connected together through the openings thereof, said bars having undercut edges and the active material held thereby.

607,093. ELECTRICALLY HEATED ROLL; F. P. Snow, of Lynn, Mass. App. filed May 3, 1897. A hollow cylindrical shell of iron, or of other material that has slow electrical conductivity, two cylinder heads of copper, or of other highly conductive material united with said hollow shell, and a shaft of copper, or of other highly conductive material, uniting said cylinder heads, in combination with an annular core, formed of magnetic material encircling said shaft, and wound with insulated conductor, all adapted to be rotated about a common axis.

607,124. AUTOMATIC CUT-OUT FOR SECONDARY BATTERIES; W. L. Negbaur, of Brookline, Mass. App. filed Feb. 19, 1897. An automatic electric switch, comprising a magnet core provided with a non-polarized armature, a working circuit controlled by said armature, and two coils on said magnet core wound and connected to oppose each other, the said armature being operated by the differential.

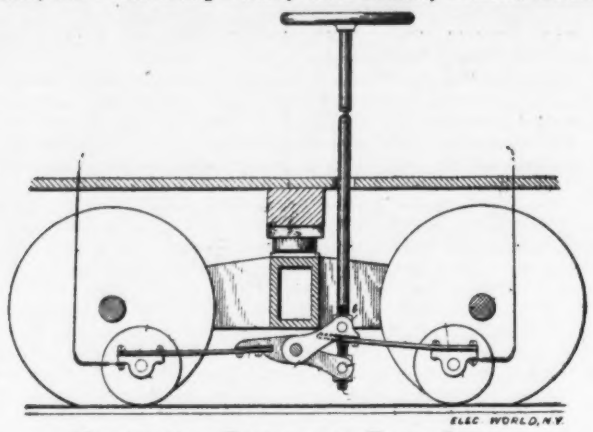
607,125. METHOD OF AND APPARATUS FOR GENERATING ELECTRICITY; W. L. Negbaur, of Brookline, and Jos. J. Feely, of Walpole, Mass. App. filed June 17, 1897. In a system for generating electricity, in combination with a storage battery, a dynamo having a magnetic shunt around its armature, a high resistance coil on said shunt adapted to be fed with a practically constant current, and a low resistance coil on said shunt connected in series with the external circuit and producing an opposite polarity to that of the first mentioned coil.

607,176. ELECTRIC BREAK FOR INDUCTION COILS; T. B. Kinraide, of Boston, Mass. App. filed Feb. 26, 1897. In an electric break, having a hammer vibrating against an anvil, and means to adjust the latter, means to rotate said anvil independently of its said adjustment.

607,177. ELECTRIC BREAK AND INDUCTION APPARATUS; T. B. Kinraide, of Boston, Mss. App. filed July 26, 1897. The combination with an electric break having an electromagnet, an anvil and a vibrating hammer, of a collector to concentrate the lines of magnetic influence, on said hammer.

607,185. ELECTRIC METER; W. D. Marks, of Philadelphia, Pa. App. filed Nov. 4, 1897. The combination with an electric meter wherein is used an ampere indicator, of a shaft, connections between said shaft and said ampere indicator, and a supplemental pointer carried by said shaft.

607,194. TROLLEY; W. H. Russell, of Chicago, Ill. App. filed May 24, 1897. The combination with a trolley arm or pole, of a base, comprising a tubular portion fitting over the trolley arm or pole, a flaring portion extending from such tubular portion upward and outward and a table at the upper end thereof, and a fork having a trolley wheel rotatably mounted therein, such



No. 607,065.—Trolley for Third Rails.

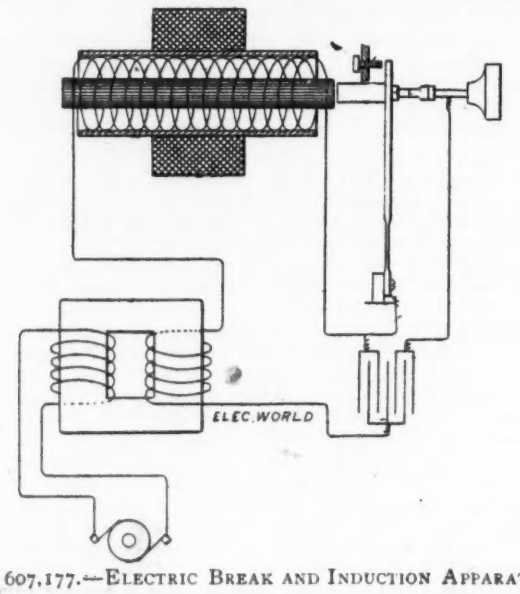
fork comprising a tubular portion fitting over the table on the base, a pivot extending, in a vertical plane, through such fork and base, an arm on the under side of the fork, extending under the base and a spring on the trolley pole, engaging with such extension.

607,239. TELEGRAPH; L. W. Hildburgh, of New York, N. Y. App. filed June 2, 1897. In a system of electrical communication, the combination with the main line and a source of alternating current therefor, of means for controlling the flow of the positive and negative impulses from the generator by short circuiting one set of impulses at the time of generation of either set of waves, the other set being unaffected.

607,247. ELECTRIC MOTOR; W. S. Johnson and Henry Winkenwerder, of Milwaukee, Wis. App. filed Nov. 9, 1896. In an electric motor, the combination of an electromagnet and armature, one of which is capable of oscillating transversely to the lines of magnetic force, a weight for moving said oscillatory part in one direction, an elastic stop for limiting the movement and reacting upon the oscillatory part, and a circuit controller arranged to close the circuit at or near the limit of the return movement of the oscillatory part produced by the weight, and to break the circuit at or near the limit of its advance movement produced by the magnet.

607,250. ELECTRIC CUT-OUT; H. A. Lewis, of Norristown, Pa. App. filed July 14, 1897. An electric cut-out, provided with a circuit breaker and an electro-thermostat, comprising a tube for connection at one end with said circuit breaker, a head on the said tube, a hollow screw rod engaging the said head, to cause the tube to expand in one direction only, and a rod carrying a wire and held in the said screw and tube rod.

607,251. FUSEHOLDER, CIRCUIT BREAKER AND LIGHTNING ARRESTER; H. A. Lewis, of Norristown, Pa. App. filed July 14, 1897. The



No. 607,177.—Electric Break and Induction Apparatus.

combination of the fixed contact, the movable circuit breaking arm, the fuse connecting said arm and contact, and the contact held movably on the said arm and adapted to engage the fixed contact when the fuse melts or breaks.

607,302. ELECTRIC LOCOMOTION; H. Van Hoevenbergh, of New York, N. Y. App. filed Nov. 20, 1896. A current collector or trolley mounted to roll on one conductor of a supply system, and elastically yielding arm adapted to make contact with the companion conductor, a guide rail on the trolley frame to force aside the arm of a trolley on the companion conductor, thereby permitting the trolleys to pass one another.

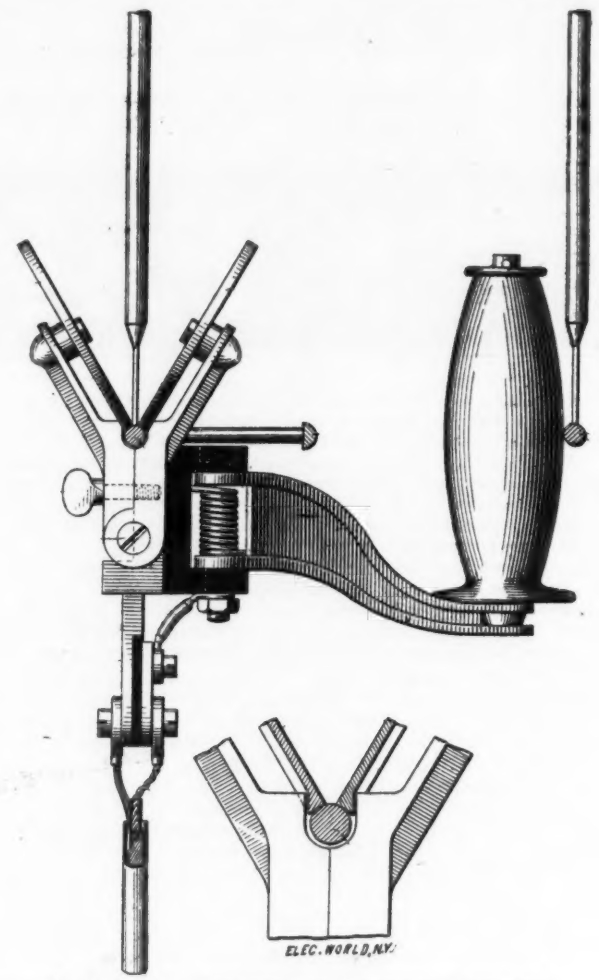
607,311. ELECTRIC CURRENT CONTROLLER; E. E. Werner, of Philadelphia, Pa. App. filed Feb. 23, 1897. The combination of the frame, a carrier journaled therein and having an annular groove in one face thereof, a hand-shaft having a friction roller bearing against one face of the groove in the carrier, and by which the carrier is turned, segmental resistance material on the carrier, a hand and a dial.

607,315. INSULATOR; C. L. Wingard, of Walla Walla, Wash. App. filed April 13, 1898. An insulator, constructed of two duplicate sections matching to form a tubular body, each section having its edges provided with interlocking shoulders, and each section also having a head provided with a notch leading to the bore thereof, through which notch the conductor may be passed, whereby the insulator may be placed on the conductor after the conductor is in place.

607,343. SWITCHBOARD AND ALARM MECHANISM; J. P. Conway, of New York, N. Y. App. filed May 5, 1897. In an electric alarm mechanism, the combination with the day and night alarm circuits, the main line being connected with the central office indicator and signaling devices, magnets adjustably secured to the switchboard, and in the main circuit having an armature lever adapted to engage with the said signaling devices, said signaling devices being provided with independent circuits, and means for closing either the day or the night circuits.

607,351. ELECTRIC RAILWAY; W. W. Doty, of New York, and James A. MacKnight, of Mount Vernon, and Charles Grauten, of New York, N. Y. App. filed Jan. 25, 1897. The combination of the feed wire, the sectional working conductor, and a series of circuit controllers, one for each section of the working conductor, each of said circuit controllers comprising a switch made with a conducting and non-conducting section, an electric actuating device electrically connected to the working conductor section belonging to that controller, and two circuit closers controlled by the switch, and so arranged that only one of them can engage the non-conducting portion of the switch at a time, one circuit closer operating, when the electric actuating device is energized, to connect the feed wire with the working conductor section belonging to the same controller, and the other circuit closer operating, when the electric actuating device is de-energized, to connect the feed wire with the working conductor section belonging to the next controller.

607,387. TROLLEY FOR ELECTRIC RAILWAYS; H. Van Hoevenbergh, of New York, N. Y. App. filed Aug. 31, 1897. A trolley provided with a



No. 607,387.—Trolley for Electric Railways.

plurality of wheels set at an angle to bear upon a supply conductor at their peripheries, said wheels being mounted in a frame provided with projections lying close to their sides to prevent spreading.

607,407. ALARM SYSTEM; C. Coleman, of Chicago, Ill. App. filed Oct. 18, 1897. The combination with an electric protective circuit, of a voltage changer situated therein at the alarm station, a device responsive to said voltage changer situated at the protected structure and acting to maintain the current constant within prescribed limits.